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EDITORIAL

TUMOR CLINIC IN GENERAL HOSPITAL

SINCE the United States census reports showed that cancer was the second commonest cause of death and that the incidence of cancer was increasing, physicians, statisticians and economists have stressed the economic loss due to cancer in country, state and county. For instance: in Columbia County in 1934 there were 79 deaths and in the city of Hudson there were 30 deaths from cancer; the estimated economic loss to the county was $395,000.

The attack on cancer has been a disappointment. The mortality rate has continued to increase and is greater in the immediate vicinity of medical centres where cancer is extensively treated due to the fact that more cancer patients are attracted to such centres.

Group attack on cancer has been necessary because: (1) the expense of radium, *x*-ray, surgical, laboratory and hospital equipment; (2) the skill and experience required to obtain the best results with such equipment; (3) the impossibility of a large proportion of individuals to stand the financial drain of protracted sickness treated in the modern method.

The most practical form of group attack on cancer is The Tumor Clinic. The term "tumor" is used advisedly in preference to cancer because there are enough benign tumors to dilute the terrors of people's imagination about "cancer." There is a general feeling that the word "cancer" should not be used in contacts with patients, even though a tacit understanding exists as to the nature of the disease being treated.

Today we know that the commonest contributing cause of cancer is irritation; that there are many different varieties of cancer; that some forms are 100 per cent curable if seen early; that most forms are incurable if seen late; that cancer today does not necessarily mean great pain, a surgical operation, huge expense, family bankruptcy and sure death. It depends on what variety of cancer one has. Knowing that

avoidance of chronic irritation of all kinds and the early learning of the truth about ourselves would probably cure more than half of the cases of cancer; knowing that early cancer *is* curable, has been cured and has remained cured over periods of five, ten and even fifteen years; all should do much to free us from the panic of cancer.

Next to the patient himself, the most important individual in the cancer problem is the physician or dentist first seen by the patient.

While campaigns to enlighten the public and to promote periodic health examinations should be encouraged, they will never get very far if advocated only by physicians. People suspect physicians of ulterior motives. Besides periodic health examinations the most hopeful field of cancer prevention is to make general practitioners and dentists realize that most cancer patients will consult them early when the symptoms are common to less serious conditions. It is definitely "up to the profession" to protect their clientele and their own reputations by becoming "cancer conscious." They should prove to themselves that any chronic irritation which has existed for more than a month is not cancer. We have no right to hazard another's chances of recovery by replying on the law of Nature's averages, i.e. that Nature will cure the majority of patients suffering with simple sicknesses. Better to have one living grateful patient than one living "knocker" who has become embittered because one of us may have overlooked a serious condition in its incipience when it was masquerading under minor symptoms.

Great damage has been done to the cancer situation by the blasé willingness of doctors to admit that they do not know the cause of cancer. Much damage has been done by procrastination in making complete examinations. Don't accept the patient's diagnosis of "piles" without an examination. Examine chronic sores, lumps, pigmented moles and cold sores of more than one month's duration; investigate unusual or bloody discharges, especially from breast or uterus; investigate bad teeth and chronic mouth infections; inquire about the excessive use of tobacco and call the patient's attention to the need of doing something to correct these conditions. Too often abstracts of patients' remarks read something like this: "Consulted Dr. ——— so many months ago, and he told me 'to let it alone'; 'let Nature take care of it'; 'it is the change of life'; 'you will outgrow it'; 'it has always been there'; 'my mouth plate makes my mouth sore, so I only use it when I dress up.'"

There are certain mutual advantages in the utilization of the personnel and physical equipment of already existing hospitals for the organization of a tumor clinic, because these represent the established centres in which modern diagnostic and therapeutic procedures can be conducted. These hospitals have the personnel and equipment for this service, and are only lacking in the definite organization together with sufficient radium, a high voltage *x*-ray machine, a radioknife and the all important triad, progressive and unselfish surgeons, competent pathologists and trained radiologists. These are necessary to attain a competent, trustworthy tumor clinic.

Approved general hospitals have already established their reputation in their community and the tumor clinic will benefit by this credit. The affiliation of the tumor clinic with the general hospital is the most economical arrangement possible, as it enjoys the advantages of clinical quarters, hospital beds, interne and nursing staff.

The minimal requirements for a tumor clinic have been outlined by the American College of Surgeons. It should be recognized that the tumor clinic is the scientific antithesis to the "one man racket." It is necessary from the very beginning to combat selfish individualism by convincing the staff that the conquest of cancer is not a one man game, but a problem so large and intricate that it needs the combined skill of physicians who have vision, enthusiasm, energy, ambition and sufficient grasp of the sociologic factor to disarm jealousy and elicit cooperation.

The best answer to the cancer problem to date is the Tumor Clinic. Cancer is not a one man job. The group attack by the formation of a Tumor Clinic in general hospitals when well organized and equipped offers the best approach to the ideal of a 50 per cent reduction in cancer death rate. Group attack is necessitated by the broadness of the subject, the expense and the personnel necessary. The ultimate outcome of any case of cancer is largely determined by the first doctor or dentist consulted by the patient. Much damage has been done to the cause of cancer by the admission that we do not know the cause of cancer; or that we do not know the cure of cancer, by procrastination, by fear of truth, expense or death.

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TUMORS OF HEAD AND NECK*

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A BRIEF résumé of tumors of the head and neck with the various treatments indicated for the modern therapy of each condition is presented and indicates the wide scope of treatment available in the Tumor Clinic of a general hospital.

Outstanding successes have attended the treatment of basal cell epitheliomata of the skin, naevi, keloids, granulomata; limited success has resulted from the treatment of squamous cell epitheliomata of the lower lip, mouth and tongue, carcinoma of the larynx, lymphomata and lymphoepitheliomata.

Tumors of the head and neck met in the Tumor Clinic and the treatment indicated are as shown on page 394.

TUMORS OF THE EYE

There are many tumors which may be present in the eye region, as xanthoma, verruca, nevus, lymphangioma, lipoma, keloid, fibroma, neurofibroma, neuroblastoma, steatoma, cysts, infectious granuloma, basal cell epithelioma, squamous cell epithelioma and sarcoma. They require only passing comment, inasmuch as their treatment is the same here as elsewhere; namely: surgery for benign lesions which are not radiosensitive; irradiation for malignant conditions and radiosensitive lesions with or without surgery.

It must be borne in mind that irradiation of the eyeball causes cataract and lead eye shields coated with paraffine must be inserted beneath the eyelids when treating radiosensitive tumors of the eyelids.

Special mention should be made of the two commonest tumors of the eyeball: melanoma in adults and neuro-epithelioma, or glioma, of the retina in the very young.

Unilateral loss of vision without pain or infection and with no external signs of disease should suggest the possibility of an intra-ocular tumor.

Melanoma usually originates in nevi in the iris, ciliary body or choroid and is usually primary.

Glioma of the retina occurs usually in children under three years of age; in one-quarter of the cases both eyes are involved. The first symptom is the appearance of a light reflex in the dark like that seen in cats' eyes, with blindness in the effected eye. The treatment for both of these conditions is early enucleation.

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BENIGN TUMORS

Nasal polypi	Surgical treatment of complicating sinusitis; surgical removal; postoperative radium treatment.
Fibromata, Enchondroma	Surgical treatment.
Angioma, Epithelial papilloma	Cauterization or radium treatment.
Giant cell tumor	Curettage, with or without *x*-ray therapy.

MALIGNANT TUMORS

Lymphoepithelioma		This is a definitely cancerous condition. In cases presenting unexplained metastases in neck the primary growth is frequently not diagnosed until a diligent search for it is made in the postnasal space by endoscopic examination. These tumors are very radiosensitive, and should be treated by the saturation, Coutard or protracted daily doses of 200 *r* units of high voltage *x*-rays pushed to the limit of toleration.
Carcinoma	Papillary, Basal cell, Squamous cell, Cylindrical cell, Adenocarcinoma	Preliminary radiation, then surgical removal of any residual or persistent tumors. Postoperative radiation.
Sarcoma	Lymphosarcoma, Myxosarcoma, Fibrosarcoma, Mixed types, Osteogenic or Osteolytic	Preliminary radiation, then surgical removal of any residual or persistent tumors. Postoperative radiation.
Endothelioma		Preliminary radiation. Electrosurgical removal of any residue when necessary.
Carcinoma of Larynx		In those rare cases of incipient cancer of the larynx seen early enough to be in a stage where laryngofissure is indicated, the percentage of recovery is 80 per cent; in more advanced cases *x*-ray treatment has shown more than 50 per cent cases cured after five years. Since the standardization of the saturation or Coutard treatment of protracted daily doses of 200 *r* units of high voltage, heavily filtered *x*-rays to the limit of toleration, carcinoma of the larynx may be definitely classified as primarily a radiologic problem, just as carcinoma of the cervix uteri or basal cell epithelioma are now recognized to be best treated by radiologic methods. If laryngeal or dental surgery is contemplated in these cases, it should be done before the heavy radiation is completed to avoid dangers of osteomyelitis or chondritis. In this field deep *x*-ray therapy has for a time virtually supplanted implantation radiation, but there is a field for both methods. In certain quarters early block dissection of the cervical lymph nodes is popular, but few general surgeons have mastered the exacting tedious technique for such operations.

SUMMARY

Success has attended the treatment of certain tumors of the head and neck by surgery, *x*-ray and radium,—namely, basal cell epitheliomata, nevi, keloids, lymphoepitheliomata, granulomata. Ultimately less success has attended the treatment of squamous cell epitheliomata and lymphomata. Benign and malignant tumors of the head and neck with the treatment indicated for each are discussed.

MODERN TREATMENT OF CARCINOMA OF UTERUS*

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OUR present day conception of adequate treatment of cancer of the uterus is based upon the usage of methods other than surgery. We have learned from clinical and postmortem examinations that cancer of the uterus tends to remain localized in the pelvis without widespread lymphatic involvement for a considerable period of time. This coupled with earlier diagnosis is of obvious importance in diminishing the death rate of malignancy of the uterus, which occupies first place as the cause of death from cancer in the female according to present day statistics. In view of the essential differences between cervical carcinoma and carcinoma of the uterine corpus, these will be considered individually.

CARCINOMA OF THE CERVIX UTERI

About 90 per cent of all cancers of the uterus are located in the cervix and commonly occurs during the active period of child bearing; however, it is by no means rare before the age of twenty years. The repeated injuries to the cervix, incident to childbirth and the chronic erosions and infections associated therewith, appear to be important etiological factors. For these reasons, the lesion is more frequent among negresses who usually bear more children than whites.

Modern statistics show that there is a five year cure of about 25 per cent of all cases of carcinoma of the cervix. Obviously the percentage of cures is dependent upon the extent of the growth when discovered and the adequacy of treatment. For example cases falling in group I of the Schmitz classification show a five year cure rate of about 66 per cent; group II shows a 50 per cent five year cure rate; in group III the percentage falls to 20 and in group IV there are no five year cures.

As generally observed from a clinical point of view, cervical cancers are either of the everting, or cauliflower type, or the inverting, or ulcerating type. Here as elsewhere in the body, the malignant lesion which advances to meet you is less dangerous that the one which retreats and burrows away from you. So, the ulcerating type tends to involve other structures earlier and invades the parametrium and lymphatics more promptly than the cauliflower type of tumor. These tumors may also be divided into those arising from the portio vaginalis and in the cervix proper. From a histological point of view, cancer of the cervix is either epidermoid or adenocarcinoma, the former constituting about 95 per cent. A third type of cervical tumor, the adeno-acanthoma represents a combination of these two but accounts for few actual cases. However, the cellular nature of the tumor has little to do with its clinical appearance although it may be of considerable importance in therapy and prognosis. As the tumor mass of the cervix enlarges, it frequently closes the cervical canal with a resultant damming back of secretions into the uterine cavity, thus producing a pyometra. The presence of infected tumor tissue and granulations about the cervix or a pyometra increases appreciably the hazard of treatment of the primary condition. The pathologist grades cervical cancers as I, II, III and IV based upon the amount of differentiation of the tumor cells; we use this grading clinically in classifying these tumors as to their sensitivity to irradiation and as an aid in formulating a prognosis. For statistical

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purposes, cancers of the cervix are classed into groups depending upon the extent of the lesion. There are several of these classifications, Schmitz, College of Surgeons, League of Nations, etc. The simplest of these is the one of Schmitz; group I includes all cases in which the tumor is limited to the cervix; group II includes those cases in which there is some involvement of the fornices; group III includes cases in which there is real involvement of the parametrium with fixation of the uterus; group IV includes those cases where there is more distant involvement or metastases.

Most patients with carcinoma of the cervix give a history of several labors. They complain that they have had increasing vaginal discharge over a period of weeks or months and there may be bleeding between periods, after coitus or defecation, or the regular periods may be prolonged and more profuse than normal. As a rule profuse bleeding and pain are relatively late symptoms.

Inspection of the diseased cervix, with the patient in the knee chest posture, is the first step in examination; for this, adequate illumination is essential. Next the cervix should be carefully palpated and the examining finger inspected for blood; the fornices are then examined and the mobility and size of the uterus noted. The usual abdominal examination for masses, tenderness or palpable glands is also done. To confirm the diagnosis of cancer, a biopsy is required. This may be done with a punch, scalpel, scissors or electrosurgical loop. Any possible potential risk of biopsy is strongly overweighed by the value of a positive diagnosis and the knowledge of the histology of the tumor. As a means of selecting the area from which tissue is to be removed for microscopic study, the Schiller test is used. In this, the cervix is painted gently with Lugol's solution; normal areas of the cervical tissue stain deep brown on account of the high carbohydrate content of normal cervical epithelium, whereas, diseased areas or tumor tissues do not take the stain because their cells are low in carbohydrates. The test in itself does not indicate malignancy but merely shows us the site of abnormal cells from which biopsy should be taken.

In the treatment of carcinoma of the cervix we have at our disposal, surgery, radium and deep *x*-ray therapy. Modern statistics do not seem to justify surgery as a satisfactory method of treatment. It is true that in group I (Schmitz) cases, surgery does offer as high a percentage of cures as radium but it carries with it an appreciable primary mortality rate of almost 5 per cent, while radium does not. In cases of groups II and III, the results of irradiation therapy are so superior to those of surgery, that the latter can not claim any consideration. Our plan of treatment at the Tumor Clinic of the Memorial Hospital of Albany, includes preliminary deep *x*-ray irradiation of the pelvis through the several known portals; such a course of treatment presumes the delivery of about 3000 *r* units to the skin. This preliminary irradiation clears the infection in and about the cervix and corpus and at the same time delivers a cancericidal dose to many of the tumor cells. Such treatment will require from ten to twenty-one days depending upon the patient's reaction. At the conclusion, radium treatment is given. Fatal peritonitis following primary insertion of radium into the cervix has not been uncommon; the danger of this is minimized by a preliminary course of deep therapy treatments. In our Clinic we have adopted the French technic in which a comparatively small amount of radium is used over a long period of time in contrast to other technics in which large amounts are used for short periods. Numerically, the milligram-hour dosage would be the same whether we used 200 mg. for thirty hours or 50 mg. for one hundred twenty hours. Biologically, however, there seems to be a marked difference in the results obtained with considerable advantage for the French technic. The radium is arranged in capsules each containing 10 to 15 mg. and shielded with

brass, lead or aluminum and also with rubber. In therapy work, only the gamma rays are of value so the alpha and beta rays are eliminated by these filters. The bladder and rectum must be protected to prevent irritation or ulceration. Usually an indwelling catheter is placed in the bladder so that throughout the treatment, the bladder remains collapsed and further away from the source of radiation. One or more capsules of radium are inserted into the cervix; then using the colpostat, further capsules are secured, one on either side of the cervix. Usually we utilize a total of about 50 mg. of radium. After all the radium is in place, the vagina is well packed with gauze to keep the applicators in place and to push away the bladder and rectum. Generally we leave the radium in place for a total of one hundred twenty to one hundred thirty-three hours which gives a total dosage of 6000 to 7500 mg. hours. If the patient becomes too uncomfortable, the radium is removed, a douche given and after a rest period of several hours, the radium is replaced. This total dosage is large but tissues will stand a much greater dosage if given slowly. This large dosage kills off the cancer cells instead of merely devitalizing them and eliminates the need of a repetition of the treatment, the value of which is questionable; furthermore, tumor cells apparently become more resistant with repeated radiation, while cells of the surrounding tissues tend to undergo degeneration. It should be noted in passing that the margin of safety between a cancericidal dose of gamma rays and the lethal dose for normal cells is not great. For recurrences of cervical carcinoma, we have found deep *x*-ray therapy of more value than radium.

CARCINOMA OF THE UTERINE CORPUS

Carcinoma of the body of the uterus composes about 5 per cent of all cases of uterine cancer. Usually it occurs in women at the end of the child bearing period, from forty-five to sixty-five years being the common ages. The association of adenocarcinoma of the body with myomata is quite frequent; probably 10 per cent of cancers of the body are found in association with myoma.

The prognosis in cancer of the body is somewhat better than in cancer of the cervix; the average percentage of five year cures is 33.

We find cancer of the body of the uterus commonly occurring in two clinical forms. In one there is a sharply circumscribed papillary mass that may be easily removed in its entirety with a curette. In the other form there is diffuse involvement of the endometrial lining giving rise to a bulky mass, obviously, growing more rapidly, soon extending through the uterine wall either by the lymphatic channels or by direct extension. The pathologist classifies these growths as papillary adenomas, malignant adenomas and adenocarcinoma. Carcinoma of the corpus tends to remain localized within the uterus for quite a long time and consequently offers a reasonably good prognosis.

The symptoms of carcinoma of the uterine corpus are vaginal discharge or bleeding. There may be some increase in the menses or some intermenstrual bleeding in the woman who has not passed the menopause. In the woman who has, there is often a history of the appearance of a vaginal discharge with spotting. Such complaints justify a diagnostic curettage at least. A negative report on the curettings should not be accepted in face of a positive history but should indicate further investigation.

In our Clinic we have discarded radium in the treatment of cancer of the body. Our reason for this is the ever present danger of forcing infectious material out through the tubes by the insertion of radium and packing; also it is unreasonable to expect to make and maintain satisfactory contact between the radium and the lesion. Following radium treatments, there is still the uncertainty that all the cancer cells have been killed and so resort to surgery must be made. We have adopted as our standard

the use of deep therapy irradiation followed by panhysterectomy. Deep therapy given in satisfactory dosages through the several available portals, tends to sterilize the interior of the uterus and causes death of most of the cancer cells with little risk. At the completion of these treatments, removal of the entire uterus and adnexa is done. It is true that deep therapy treatments do add to the difficulties of operation but these are more than compensated by the greatly lowered incidence of infection and recurrences which follow. Radical surgery of the Wertheim type, without previous deep therapy, has resulted in some satisfaction but even in the hands of the expert it carries a mortality rate of over 10 per cent; for this reason its use is being discontinued in most clinics today. Recurrences after any method are best treated by deep *x*-ray therapy.

SUMMARY

Carcinoma of the uterine cervix is usually of the epidermoid type. Accurate histological diagnosis by biopsy is essential; biopsy risk is very slight. Cervical carcinoma is best treated by a combination of radium and deep *x*-ray therapy; by the use of the deep therapy before radium application, the danger of fatal peritonitis is minimized. Surgical treatment has proved inadequate in comparison to radiotherapy.

Carcinoma of the uterine corpus is usually of the glandular type. Diagnosis can generally be made by a curettage but should be suspected in patients who commence to have discharge or bleeding after the menopause. Carcinoma of the body is best treated by a course of deep *x*-ray therapy, followed promptly by a panhysterectomy.

CANCER OF RECTUM*

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STATISTICS indicate that a little over 5.5 per cent of all cancer deaths occur from cancer of the rectum and anus, and two-thirds of all colonic cancer are situated at or below the rectosigmoid flexure. This is a fertile field for the reduction of mortality figures, inasmuch as it is readily accessible to the palpating finger and direct visual inspection.

The majority of these tumors unquestionably arise on the basis of preexisting benign adenomata, as cancer and adenoma are frequently coexistent. Yeomans and Horsley both stress the propensity of the adenomata to malignant degeneration. Chronic ulcerative colitis with its sequel, multiple polyposis, is notoriously known to be followed by cancer. Rosser reported a series of cases in which cancer was engrafted on chronic hemorrhoidal disease, fistula and fissure. Obviously, elimination of all chronic rectal pathology and more frequent routine proctosigmoidoscopic examinations are wise prophylactic measures.

It has been determined that the average individual has had suggestive symptoms for a period of eight months before anything except palliative treatment has been employed. The earliest symptomatology is usually that of vague abdominal distress and change in the habitual action of the bowels. There may be abnormal secretion of mucous, perhaps blood tinged and some general debility. Only late in the disease do we get marked weakness, loss of weight, pain and profuse discharge. The elicitation of vague intestinal symptoms during the course of a painstaking history calls for a thorough proctoscopic examination.

The diagnosis of cancer of the rectum is effected by digital and proctosigmoidoscopic examinations together with a study of the tissue removed with the biopsy forceps. The palpating finger is a most valuable piece of diagnostic equipment, as 60–75 per cent of all rectal tumors may be discovered in this manner alone, if the patient is requested to strain in the squatting position. Carcinoma has a distinctive granular or nodular, indurated feel. The vegetative type encroaches on the lumen of the bowel and may be felt as a distinct mass. In the ulcerative type, the finger encounters an indurated border and definite crateriform excavation. In the latter type, there is early invasion of the entire gut wall together with extension to contiguous structures. Fixation is the rule, partly due to the inflammatory reaction of the infection. Introduction of the electrically illuminated proctosigmoidoscope clinches the diagnosis, at which time a biopsy is done. The tissue is sent to the pathologist for confirmation of the diagnosis and to determine the type of tumor, its relative malignancy and radiosensitivity. A roentgenogram is unnecessary in establishing the diagnosis of a lesion which may be palpated or seen with the naked eye. Where there is marked stenosis not permitting the passage of a sigmoidoscope of small diameter, the taking of a barium enema picture is justified. Great care should be exercised in passing the proctosigmoidoscope, inasmuch as perforation of a wall weakened by carcinomatous change is not uncommon.

Cancer of the rectum must be differentiated from amebic granuloma, the granuloma of chronic ulcerative colitis, diverticulitis, lymphogranuloma inguinale otherwise known as lymphopathia ven-

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ereum, hyperplastic tuberculosis and certain benign tumors, as villous papilloma. In the case of amebiasis, the endameba histolytica will be discovered microscopically in the warm, liquid stool and tissue examination will, of course, reveal its granulomatous nature. Diverticulitis is an extramural lesion and simulates carcinoma only in the stenosis it produces. Lymphogranuloma is eliminated by application of the Frei test and the microscopical examination of excised tissue. Hyperplastic tuberculosis, certain benign tumors and the granuloma of chronic ulcerative colitis are differentiated from carcinoma by tissue examination.

Treatment may be palliative or radical and consists of surgery, deep *x*-ray therapy and radium employed singly or in combination. In a recent report of a series of cases, massive coagulation has proved of some value. We believe that a particular type of treatment must be selected for each individual case and that this is preferable to routine methods. The type of treatment selected depends largely on such variable factors as: the age of the patient, his general condition, accessibility of the tumor or its location, degree of obstruction present, fixation of the growth with involvement of contiguous structures and radiosensitivity. Squamous cell carcinoma originating in the anal canal distal to the dentate line metastasizes to the inguinal nodes. These latter must be considered in planning any adequate form of therapy for this lesion.

The most effective surgical procedures are abdominoperineal resection in one or two stages with colostomy, and perineal resection with or without colostomy. Perineal resection is reserved for low lying tumors and should include the sphincter musculature, ischiorectal fat and retrorectal fascia and nodes.

It is our custom in rectal ampullar growths to give a preliminary course of deep *x*-ray therapy. The Coutard or saturation method is used which permits an attack upon the malignant cell in its various phases of reproductive activity. It has a salutary effect in reducing infection; stemming the progress of the disease; mobilizing the tumor when fixed and inhibiting the growth of cells disseminated along the lymph channels. The interstitial implantation of radium emanation seeds is often used for the same purpose. Gold or platinum filtered seeds of 2–3 millicuries each are placed approximately 2 cm. apart. A combination of these remedies is markedly effective in preparing the operable case for surgery and as a palliative measure in the inoperable. Very often the so-called inoperable case responds so well to irradiation that the patient becomes an excellent surgical risk.

CONCLUSION

Reduction of the mortality rate of cancer of the rectum can be accomplished by more frequent routine proctosigmoidoscopic examinations and the eradication of predisposing lesions. Success in the treatment of the disease depends on an early diagnosis established by a painstaking history, digital and instrumental examination. Radium and deep *x*-ray therapy in combination with surgery, planned to suit the particular requirements of the case, is most effective and is recognized as the best available form of treatment.

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TUMOR CLINIC AND PATHOLOGIST*

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THE pathologist's chief obligation toward the tumor clinic is to aid in the diagnosis of the presented cases. That he can enjoy an unprejudiced view of the results of the treatment applied by the surgeon, the internist and the radiotherapeutist also may permit him to judge the merit of various therapeutic measures and perhaps to correlate the work of these important clinical groups. Lastly, he is in a position to encourage and aid programs of investigation and research.

The close association of pathologist and clinician that is made possible by the tumor clinic is of mutual benefit. If the pathologist is to diagnose and attempt to predict the outcome of a given new growth, it is very important that he acquaint himself with the clinical signs and manifestations associated with that neoplasm. The tumor clinic affords him an opportunity to view a questionable lesion in situ and to gain first hand information from his clinical confreres concerning the symptoms and physical signs that the patient presents. In turn, he may suggest methods of study from the laboratory standpoint. Various laboratory procedures may be indicated: gross and microscopic study of a portion of the tumor, bacteriological examinations, serological tests, chemical analyses, and the numerous procedures that are included under the heading "clinical pathology," such as blood counting, sedimentation rates, Aschheim-Zondek tests and urinalysis.

The value of gross and microscopic examination of tissue removed from the living was first emphasized in the middle of the last century, but this practice has become well established only in recent times. At the 1933 convention of the American Medical Association, McGraw and Hartman[1] read an excellent paper on the historical development of the biopsy and its present status. Perhaps the biopsy enables the pathologist to aid in the diagnosis, and to some extent, the prognosis of a tumor better than any other single procedure. If satisfactorily taken and carefully studied it is a source of much information with very little accompanying danger to the welfare of the patient.

There are several acceptable methods of taking a biopsy. If the lesion is on a visible surface and is reasonably small, it should be excised completely with a surrounding rim of normal tissue. If its size does not justify complete excision, a viable portion of the tumor may be removed. If possible, this should be taken from the margin so as to include part of the adjacent normal tissue. Trauma to the tissue by manipulation and squeezing which occurs if scissors, snares or punches are employed, is to be avoided, therefore removal with a sharp scalpel makes the most satisfactory specimens.

It is at times desirable to use some type of electrosurgical or endothermic instrument to facilitate hemostasis and to seal the exposed lymphatics. If such a method is selected, the surgeon should use the high frequency cutting current while removing the biopsy[2] and reserve the coagulating current for subsequent treatment of the field of operation. Coagulated tissue exhibits little or no histologic detail. If the specimen removed is of a reasonable size, the narrow peripheral trauma of the cutting current will not interfere with the microscopic study. We have studied some very satisfactory biopsies of the larynx, bronchi, urinary bladder and prostate removed by the cutting current. The rising popularity of transurethral resections supplies much such material. Also, external surface lesions are removed often by the "radio knife."

The biopsy is also adaptable to tumors beneath the body surface completely surrounded by normal tissue. Here too, if the tumor is small enough, it should be completely excised. However, if necessary,

* Read as part of a symposium presented by the Tumor Clinic of the Memorial Hospital of Albany before the Staff of the Hudson City Hospital and the Medical Societies of Greene and Columbia Counties, December 10, 1935.

there is no great danger in cutting into the mass. Again electro or chemical cautery may be used to minimize any possible danger of stimulating or disseminating the neoplasm. In this connection, Bloodgood has recommended the use of pre and post-operative irradiation.[3]

The aspiration biopsy as described by Martin and Ellis[4] has been highly recommended, particularly for biopsy of tumors beneath the surface. The method requires especial skill on the part of both the clinician and the pathologist, and even in the hands of the group in the Memorial Hospital, New York City where it has been used quite extensively, the procedure has distinct limitations. This group has performed several hundred aspiration biopsies of many types of tissue in various locations; lymph nodes, salivary glands, breast, bone, prostate, lung, thyroid, tonsil, antrum, tongue, and other sites. In some instances the procedure has indicated the specific nature of the tumor, in others it has differentiated between neoplasm and inflammation, malignancy and benignity, and ectoderm and mesoderm. At times no diagnosis was possible and in some instances incorrect diagnoses were indicated. If anyone contemplates the use of the aspiration biopsy, he should study the papers of Martin and Ellis,[4,5] Coley, Sharp and Ellis[6] and Stewart.[7] These authors have carefully described the details of the procedure and have indicated its advantages and pitfalls. The method seems to be definitely established as a diagnostic procedure at the Memorial Hospital, New York, but its difficulty probably will prevent its general usage.

The Hoffman punch is an instrument devised by Hoffman[8] of the Memorial Hospital, New York City, for use in biopsy of deep seated tumors. It consists of an insulated tubular sheath containing a lancet pointed steel obturator which projects a short distance beyond the end of the sheath. When the instrument is inserted into a tumor and the obturator withdrawn, a cutting hook near the distal end of the obturator removes a small portion of the tissue. An electrode is then introduced and the puncture tract is coagulated. Lowsley[9] recently described a punch instrument which he has used successfully in obtaining, through the perineum, biopsies of the prostate gland. He recommends its use for other deep seated tumors. These methods have certain merits but they require experience and dexterity on the part of the operator and entail certain disadvantages to the pathologist.

When a biopsy has been completed, if an immediate diagnosis is necessary, the freezing microtome is the best instrument adapted for rapid sections. Other procedures, such as cutting thin slices of the tissue with a razor blade or mounting surface scrapings or teased bits of tissue on a slide, present obvious disadvantages for satisfactory microscopic study. Von Haam[10] has advocated the use of the "Leitz Ultropaque," an instrument which illuminates the stained surface of thick opaque segments of tissue, making a study of the cellular detail readily available. However, the instrument has not won wide acclaim.

However, biopsies should be eventually studied after the slower preparation of sections of paraffin or celloidin embedded tissue. For this purpose, the surgeon may submit the specimen in a preservative, 10 per cent formalin is a satisfactory, commonly used fixative. At times it is desirable to preserve the tissue in the cold and submit it to the pathologist without chemical fixation. This is particularly necessary if any bacteriological procedures, as culture or animal inoculation, are indicated.

The conception that biopsy of a tumor stimulates its local growth and tends to disseminate neoplastic cells has been largely disproved. Wood's[11] experimental work with 673 rats similarly inoculated with Flexner Jobling rat carcinoma, showed no more progress of the new growth in a group that were biopsied ten to twelve days before radical removal of the tumor than in a control group subjected to radical operation without previous biopsy. Metastasis demonstrable at postmortem examination was used as an index of tumor progression. In a review of 7000 patients

Simpson[12] observed no ill effects resulting from biopsy. At the Curie Institute in Paris, biopsies of 825 carcinomas of the lip were performed without evidence of harm to the patients.[1] If one accepts Bloodgood's statement[13] that the chief danger of biopsy lies in a mistaken diagnosis which may lead to an unnecessary radical operation, then he should choose that form of biopsy which gives the pathologist the best possible opportunity to study the lesion.

Under optimum conditions, the biopsy affords a valuable fund of information. It is the accepted method of accurate specific tumor diagnosis. Worthwhile tumor clinic statistics must be based on material diagnosed in this manner. The histologic nature of a neoplasm will often aid in the selection of the proper method of treatment. The pathologist's report may contribute much toward determining the prognosis of a given case.

A great deal has been written on the subject of grading neoplasms to determine their prognosis and their radiosensitivity. Broders'[14,15] grading of carcinomas of the lip into four groups was one of the earliest attempts. Hueper's[16] method of grading malignancy was applied to carcinoma of the cervix. He evaluated twenty variable histologic factors numerically and from the sum of these values placed the neoplasm in one of four sections. Gates and Warren[17] recently published results of grading 5052 epidermoid carcinomas from various sites. The underlying histologic principle of all of the methods seems to be that a well differentiated neoplasm, one closely resembling the host cells from which it originated and a relatively inactive neoplasm, as judged by the infrequency of mitosis and slight invasiveness, should be considered a low grade malignancy. On the other hand, an embryonic appearing or anaplastic new growth with many mitoses and much infiltration is given a high grade of malignancy. The collected statistics seem to definitely indicate that, in general, group I neoplasms have a much better prognosis than those in group IV. However, all the authors admit that the histologic grading of the new growth must be supplemented by various clinical observations.

The histologic criteria that determine the grade of malignancy are essentially the same as those which determine the radiosensitivity. Thus, in general, the higher the grade indicated, the more radiosensitive is a neoplasm considered. Paradoxically, the histologically highly radiosensitive tumors, that melt away under irradiation, often have an ultimately poor prognosis. In this sense, radiosensitivity must not be confused with radiocurability, for many of the so-called grade I carcinomas, histologically relatively radioresistant, eventually may be cured by irradiation. The radiosensitive basal cell carcinomas or nonkeratinizing epitheliomas of the skin, often cured by irradiation, are one of the exceptions to these statements.

In conjunction with the grading of neoplasms, a word might be said about the diagnosis "precancerous" that is often made. Hellwig[18] has written an excellent review of the diagnosis of tumor biopsies. Concerning precancerous lesions, he has concluded: "No morphologic method can decide whether a non-carcinomatous, atypical cell proliferation will actually develop into cancer or prove to be entirely harmless." His solution of such cases is observation with later biopsies, if indicated. Te Linde's[19] recent paper includes photomicrographs of "cancer-like lesions of the uterine cervix" that would tax many a pathologist's diagnostic acumen. He has observed a group of 24 such patients for periods of one to ten years and in spite of no therapeutic interferences, none of the lesions has progressed to recognizable cancer. He quotes Robert Meyer on this subject that "the question of whether a lesion is malignant or benign can be determined only by the patient's subsequent clinical course," and concludes that "there is as yet no microscopic picture from the cervix which can justifiably be interpreted as a transition between the benign and the malignant." If one wishes to use the term loosely, then every lacerated cervix of a multipara or inflamed lip of a pipe smoker is a "pre-cancerous" lesion, but, until the pathologist's technic is improved, he must content himself by occasionally communicating to the surgeon that he is in doubt

about the exact status of a given lesion, and recommend "watchful waiting."

For the last twenty-five years, various attempts have been made to diagnose malignancy by serological methods. That none of the reported methods has gained wide acclaim indicates the unsuccess of this approach to date. MacFarland, Clark, and Friedman[20] recently attempted to confirm the diagnosis of malignancy with Gruskin's cancer antigens in a series of patients with known neoplasms in the Philadelphia General Hospital. They also examined a series of normal controls. They concluded that the test was of little or no practical clinical value. Fuchs' test, a carcinoma reaction dependent upon a highly refined method of determining the non-protein nitrogen of the blood serum, received a similar evaluation when tried by the German workers, Friedl and Kulka.[21] Lundy[22] recently presented a modification of the Lehmann-Facius complement fixation reaction for the diagnosis of carcinoma. Beneficial results may develop from the experimental work of the serologist on the cancer problem but as yet the clinician cannot depend on a diagnosis of malignancy made in this way.

In conclusion, it should be emphasized that deceased patients who have been studied in the tumor clinic should be examined at necropsy whenever possible. No other method permits a more complete study of the progress of a neoplastic process and the effects of instituted therapeutic measures.

SUMMARY

The pathologist's duties toward the Tumor Clinic are to aid in diagnosis, to evaluate various types of treatment and to encourage and direct research. The close association of pathologist and clinician made possible by the Tumor Clinic is of mutual benefit.

Various methods of obtaining biopsy specimens and preparing them for microscopic study are discussed. The danger of biopsy is considered to be minimal. The diagnostic import of the biopsy is stressed; and the grading of neoplasms histologically, with reference to prognosis and to radiosensitivity is analyzed briefly.

The serological diagnosis of malignancy seems to be of little practical value. At present, it is an experimental field which possibly may prove productive.

The importance of necropsy in the study of neoplastic disease is emphasized.

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ALTERNATIVE METHODS FOR RESTORING GASTROINTESTINAL CONTINUITY AFTER GASTRIC RESECTION FOR CARCINOMA

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ROCHESTER, MINNESOTA

THE surgical excision of malignant lesions of the stomach offers the only prospect of cure, especially if it is done while the disease is confined to the stomach or to those lymphatic structures that can be removed with the growth. Since this is a disease which is otherwise hopeless, the principles of surgical management become most important, because the more safely an operation can be conducted, the greater readiness there will be for the patient to accept immediate operation if the disease appears to be limited to the stomach. The various factors of safety which have been evolved in gastrectomy for gastric cancer have become well known; and, when such principles of management are followed there is a mortality of only 10 per cent or less. Experience has shown that the chief factors of safety are: (1) preparation of the patient for operation, (2) use of the most innocuous type of anesthesia to minimize pulmonary complications, (3) complete removal of the diseased area in the stomach, (4) properly performing the technical details of the operation itself, (5) scrupulous asepsis, (6) the use of methods of restoration of continuity following removal, and (7) after care.

Certainly not the least important of the factors of safety is the choice and performance of the various methods for restoring continuity after a resection is done, and one of the most difficult problems in the development of this field of surgery is that of finding safe methods of gastrointestinal reconstruction. In cancer the most dreaded complication was leakage from a suture line, and various suture angles became known as "fatal" suture angles. With a better understanding of suture anastomosis, such points of particular danger became less of a menace; and with the understanding that undue tension was more often the cause of leakage than any defect in the suturing itself, such accidents became less frequent. Again, the importance of avoiding postoperative gastric retention in every possible way has long been recognized. Furthermore, to make sure of a secure suture line, the anastomosis must be made with healthy tissue. Added to these general factors of safety, the routine of providing ample reinforcement and protection of all suture lines and the duodenal stump has become an established practice. Probably of most importance in a satisfactory gastrointestinal anastomosis is the selection of the safest methods by which it can be accomplished.

The Billroth 1 procedure is an example of an operation which could not be done with safety in the early days of gastric surgery, but which now can be performed in suitable cases with no more risk than other methods of resection. The operation was discontinued because of the high percentage of fatalities due to leakage from the suture line, but now this menace is no greater than in other types of resection. In cancer of the stomach, however, the Billroth 1 operation has a very limited application because it has only one advantage and several disadvantages. The advantage is that in cases of small carcinomas in the antrum, in elderly patients who are not good risks and in whom the duodenum is unusually mobile and of large caliber, the operation can be done more expeditiously than any of

those procedures which involve independent closure of the duodenum; or in rare instances of anatomical abnormalities it is not possible or feasible to make use of the jejunum to restore continuity. The conditions, therefore, under which a Billroth I procedure might be indicated are extremely scarce because of the rarity of the conditions just mentioned, and because of the disadvantages, the most important of which are: (1) the attempt to perform such an operation may unduly curtail the scope of the resection, (2) the suture lines are not as secure as when the stomach is united to the jejunum, and (3) if recurrence occurs, it is likely to develop in the vicinity, at least, of such an anastomosis and be responsible for obstruction.

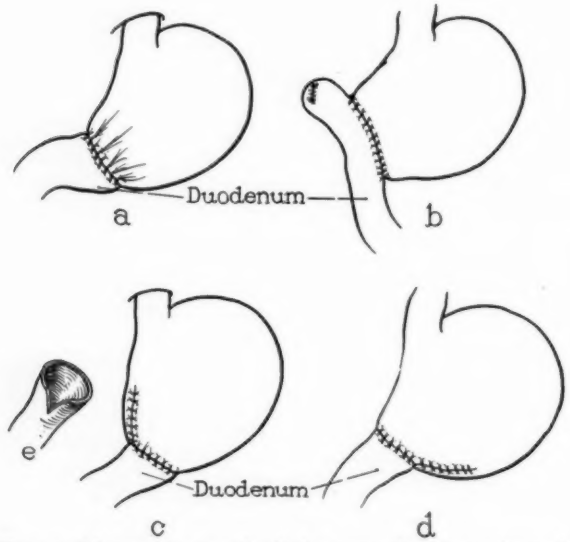

FIG. 1. Alternative methods for restoring gastrointestinal continuity after resection of stomach for carcinoma: *a*. end-to-end anastomosis; *b*. end-to-side anastomosis; *c*. anastomosis of end of duodenum to greater curvature of stomach; *d*. anastomosis of end of duodenum to lesser curvature of stomach, *e*. splitting duodenum to increase perimeter.

When the operation is indicated, the methods of reuniting stomach and duodenum are many: 1. Occasionally the entire end of the stomach can be united to the end of the duodenum (Fig. 1*a*). 2. The end of the duodenum can be closed and the end of the stomach united to the second portion of the duodenum (Fig. 1*b*, von Haberer-Finney). 3. A portion of the end of the stomach may be closed and the remaining opening of the end anastomosed to either end or side of duodenum; this may be done at either the greater (Fig. 1*c*, Schoemaker) or lesser curve of the stomach (Fig. 1*d*, Horsley), and in certain cases the caliber of the duodenum may be increased at the site of the anastomosis by splitting the anterior wall (Fig. 1*e*).

Segmental resection is probably the simplest and safest method of removing a gastric cancer, yet it is probably the most rarely employed because of secondary disadvantages. When a relatively small growth is centrally located and the stomach is mobile, particularly when it is prolapsed, removal of the segment containing the growth and a direct anastomosis of the ends can be easily accomplished (Fig. 2*a*). The immediate risk of operation is reduced to a minimum. Since gastric function is not as satisfactory after such an operation, and since if a recurrence of the disease should ensue it would probably result in gastric obstruction, the operation is rarely indicated.

Local excision alone for carcinoma of the stomach should be attempted only under exceptional circumstances. The reason for this is that carcinoma rarely develops in or extends toward the greater curvature, and it is only in this situation that local excision alone can be justified. The operation, however, is extremely useful when a small ulcerating lesion is found on the posterior wall high up and near the greater curvature; the difference between local excision and extensive gastric resection is very great from the standpoint of risk, and there is probably little difference in the probabilities of cure between the two operations. Nevertheless, such a lesion is rarely encountered, so that the indications for local excision alone are rare (Fig. 2*b*).

In the greater number of gastric resections the Billroth II procedure is the operation of choice. They are many reasons for this: (1) This type of operation permits the most thorough possible removal of diseased tissue. (2) It is probably as safe as any of

the procedures. (3) It gives good mechanical function. (4) If recurrence of the disease does take place, it is seldom that there is any interference with the gastrointestinal function.

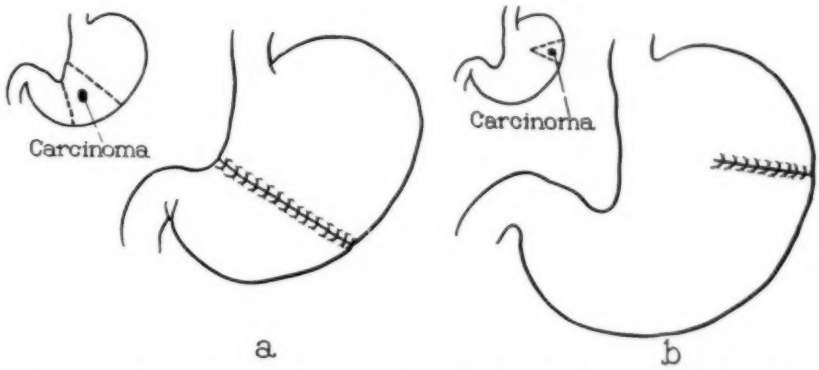

Fig. 2. Segmental resection: *a*. direct anastomosis of ends of stomach; *b*. local excision.

There are many modifications of the Billroth II procedure. Following its original establishment, it became almost universally employed, but with the introduction of methods of anastomosing part or all of the end of the stomach to the jejunum, the operation has been largely supplanted by these latter methods. The chief procedures of this type are: (1) the Billroth II with posterior gastroenterostomy, (2) the Billroth II with anterior gastroenterostomy, (3) end (stomach) to side, (jejunum), posterior, (4) end (stomach) to side (jejunum), anterior, (5) partial end (stomach) to side (jejunum), posterior, and (6) partial end (stomach) to side (jejunum), anterior (Fig. 3*a*, *b*, *c*, *d*, *e*, and *f*).

The most common procedure in this group is the posterior end-to-side anastomosis. The reason for this is that operability of a gastric carcinoma usually denotes a sufficient segment of healthy stomach above the growth to permit a satisfactory end-to-side anastomosis and one which will hang easily through the transverse mesocolon. Furthermore, the entire end of the stomach can usually be used for the anastomosis if, as an early step in the operation, the stomach has been thoroughly emptied of gas and fluid by suction. It is surprising to what extent the stomach will contract under manipulation after it has been emptied. When a posterior end-to-side anastomosis cannot be made easily because of the extent of the resection or the obesity of the patient, or for other reasons, anterior end-to-side anastomosis with entero-anastomosis becomes the operation of choice.

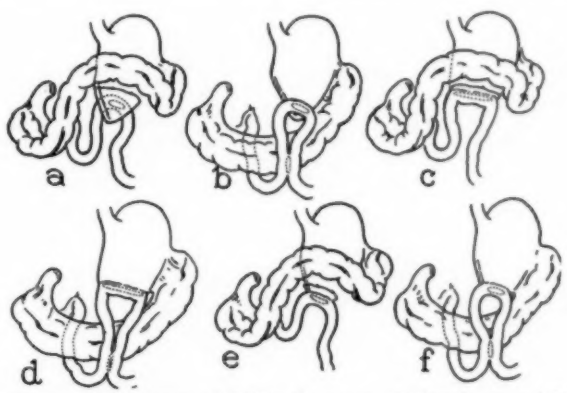

Fig. 3. Variations of Billroth II: *a*. Billroth II, with posterior gastroenterostomy; *b*. Billroth II, with anterior gastroenterostomy; *c*. end (stomach) to side (jejunum), posterior; *d*. end (stomach) to side (jejunum), anterior; *e*. partial end (stomach) to side (jejunum), posterior, *f*. partial end (stomach) to side (jejunum), anterior.

There are, however, specific indications for the other procedures mentioned. The original Billroth II is an exceedingly useful procedure in those cases in which the malignant infiltration has extended so high on the lesser curve that practically all of the lesser curve must be removed. In such cases when a Payr's clamp has been so placed above the growth and the growth removed, it is much safer to close the end of the stomach by a continuous suture behind the clamp than it is to attach the jejunum to the small remaining remnant of the stom-

ach. When closure of the end of the stomach has been completed, gastrointestinal continuity is made by a small posterior or

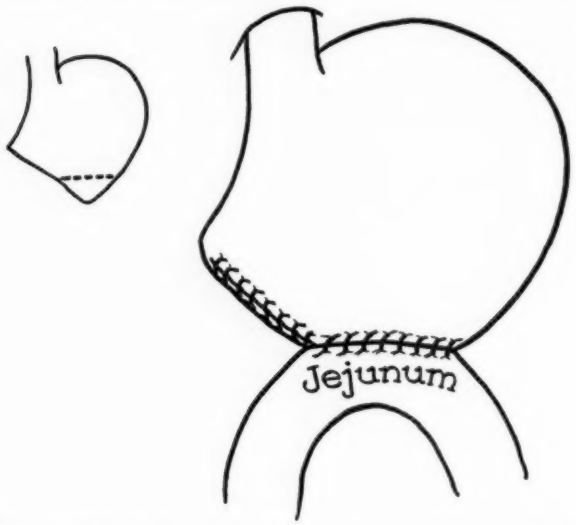

Fig. 4. Triangular piece of greater curvature removed to facilitate gastrojejunostomy.

anterior gastroenterostomy.

It may be said here that it is a safe rule in all cases of anterior gastroenterostomy for a carcinoma that a small enteroanastomosis should be made between the proximal and distal loops of jejunum. A fairly frequent modification of the end-to-side anastomosis of stomach and jejunum is to partially close the end of the stomach before making the anastomosis between stomach and jejunum. In cancer it should be emphasized that the opening between the stomach and jejunum need not be large, for in all methods of reestablishment of continuity the purpose is only a mechanical one, whereas in operations for ulcer, it is apparently true that the cure of the disease depends to a considerable extent on the actual size of the opening between the stomach and intestine.

Many methods of utilizing the remaining portion of the end of the stomach for anastomosis have been described. In some cases anastomosis is facilitated by removing a small triangular portion of the greater curvature (Fig. 4). The general indications for those procedures which involve partial closure of the end of the stomach is when the end of the stomach after resection is considerably larger than necessary for an anastomosis. This can only be determined by the experience of the surgeon, and it

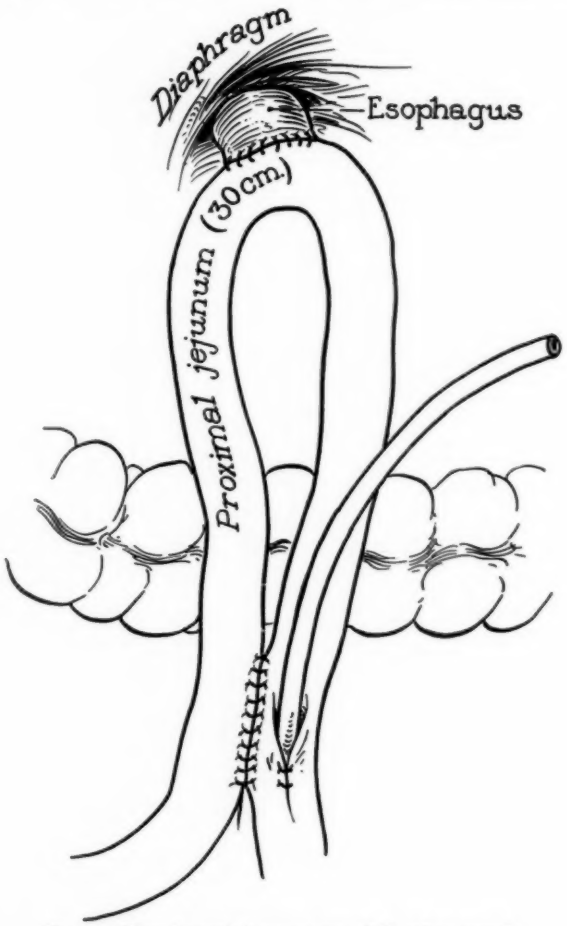

Fig. 5. Esophagojejunostomy following total gastrectomy.

should be noted that even in the case of a highly obstructed stomach a surprising decrease in the perimeter of the end can be obtained by suitable plication of the edge of the cut stomach as the suturing proceeds.

The methods of restoring continuity after total gastrectomy are either with duodenum or jejunum as in partial gastrectomy. In the former instance, after total gastrectomy, it is extremely rare that the portion of the esophagus below the esophageal opening and the stump of the duodenum are sufficiently mobile to permit safe anastomosis. In one case, the anastomosis would have been extremely simple because of the great mobility of the duodenum and the prolapsed esophagus, but

it could not be done because of the infiltration of the duodenum with inflammatory products. Esophago-jejunostomy is, therefore, the method of restoring continuity after total gastrectomy, done preferably in front of the colon, and should always be accomplished by jejunostomy, to permit complete rest of the anastomosis until there is firm healing. (Fig. 5.)

The general principles of anastomosis are well known, and detailed methods of suture will vary with the experiences of the surgeons. It is essential, of course, that meticulous care be taken to control hemorrhage. This should be done by individual ligation of the larger vessels and the proper tension of suture lines to control the smaller vessels in the line of anastomosis. Approximation should be accurate and in attempts to decrease the perimeter of the stomach before anastomosis with duodenum or jejunum, folds of the stomach edge should be avoided, for in such folds imperfect hemostasis is possible. It should, of course, be absolutely free of tension from the suture lines. The suture material should always include some permanent suture, such as silk or linen, and in cancer there is no objection to using such permanent suture material throughout. Our practice at the clinic is usually to employ chromic catgut for the inner row or rows of sutures, and to use silk or linen for the seromuscular sutures. In those cases in which it is suspected that healing will be tardy because of the age or condition of the patient, or because of prolonged obstruction, permanent suture material throughout any anastomosis is probably preferable.

As has been mentioned, it is exceedingly important that the anastomosis should be made in healthy tissue. Probably the most frequent cause of failure of the suture line to hold is because resection has not been done at a sufficient distance from the growth. In certain forms of carcinoma, although the disease may be well demarcated, marked regional gastritis is present, which results in friability of tissue in which sutures tear with the greatest ease and use of such tissue should always be avoided in building an anastomosis. In some cases in which it is impossible to remove all of this inflammatory area, the danger can be avoided largely by independent closure of that portion of the end of the stomach as mentioned elsewhere. It is unnecessary to say that particular care must be taken at all angles of the anastomosis and an important way in which this can be done is by making a routine of continuing approximation of the intestine and the stomach well beyond the actual opening between these two structures (Fig. 6).

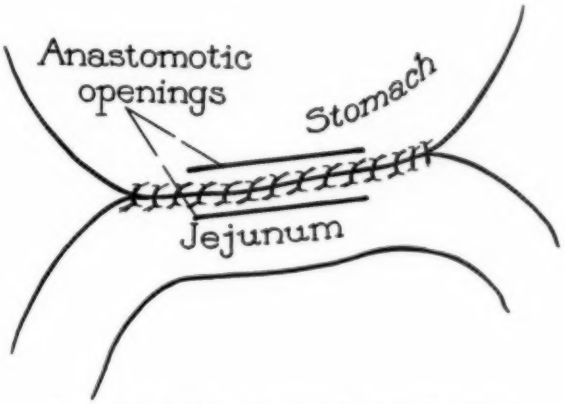

Fig. 6. Extension of suture lines well beyond anastomosis.

When the experience of surgeons throughout the world is applied to the management of cancer of the stomach, it is an excellent example of the surgical maxim that when operation is done early, the patient is given a chance for a cure with a very small risk. In one series at the clinic, there were 200 consecutive gastric resections for cancer, with 10 deaths. In late operations the chances of cure are much reduced and the danger of operation is correspondingly increased.

SUMMARY

The chief factors of safety in carrying out gastric resection for carcinoma are: (1) preparation of the patient for operation, (2) use of the most innocuous type of anesthesia, (3) complete removal of the diseased area of the stomach, (4) proper

technic in the operation itself, (5) scrupulous cleanliness, (6) restoration of continuity following removal and (7) after care.

The methods of reuniting the stomach and duodenum are: (1) anastomosis of the entire end of the stomach and the end of the duodenum, (2) closure of the end of the duodenum followed by anastomosis of the end of the stomach and the second portion of the duodenum, (3) closure of part of the end of the stomach and anastomosis of its open portion with either the end or side of the duodenum.

Segmental resection is probably the simplest and safest method of removing a gastric cancer. Local excision alone for carcinoma of the stomach should be attempted only under exceptional circumstances. In by far the greater number of gastric resections, the Billroth II procedure or one of its modifications is the operation of choice.

The general principles of anastomosis are based on general surgical principles:

1. Hemorrhage should be controlled.
2. Approximation should be accurate.
3. Folds at the edge of the stomach should be avoided.
4. There should be no tension from suture lines.
5. Suture material should include some permanent suture, such as silk or linen.
6. Resection should be done sufficiently far from the growth that anastomosis is made in healthy tissue.
7. At the angles of anastomosis, approximation of the intestine and the stomach should extend well beyond the actual opening.

Operation should be performed as early as possible in the course of the disease.

RECTAL ADMINISTRATION OF EVIPAL SOLUBLE

A SAFE, REVERSIBLE AND CONTROLLABLE PREANESTHETIC MEDICATION
A PRELIMINARY REPORT

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EVIPAL soluble is the sodium salt of evipal, known chemically as N-methylcyclohexenylmethyl barbituric acid. It dissolves readily in water and is generally administered in a 10 per cent aqueous solution, each 1 c.c. of which represents 0.1 gm. of the salt.

This new anesthetic was introduced for intravenous use in operations lasting from ten to twenty minutes. It was originated in Germany where careful laboratory tests were conducted.[1] These showed that when evipal soluble was given intravenously to cats, a dose of 25 mg. per kilo of body weight produced anesthesia, while from 100 to 110 mg. per kilo was necessary to cause death, thus giving a therapeutic index of 4. This is a higher index than that of ether, concededly the safest inhalation anesthetic. In addition, MacMahon[2] states that the therapeutic quotient, that is, the ratio between the effective therapeutic dose and the fatal dose, is 1.3 for phenobarbital, 1.6 for barbital, 2.4 for nembutal and phanodorn, and 4.0 for evipal soluble.

Evipal soluble has been used intravenously over 800,000 times in Europe.[3] In a report[4] on its value by the Anesthetic Committee of the Medical Research Council of Great Britain, 25,000 cases were observed in German clinics with only one death attributed to evipal soluble. From these figures it appears that it is decidedly safer than any other agent at present in use, even when administered by the most approved methods. The British report states: "For those who like intravenous methods, it (evipal soluble) is certainly an admirable means of inducing anesthesia." Jarman,[5] reporting on 2000 intravenous evipal soluble anesthesias, remarks that with certain provisions this agent "has a large scope in the field of safe and useful anesthesias."

In the writer's opinion because of its wide margin of safety evipal soluble will continue to be employed intravenously for short operations and without risk, by those who understand thoroughly the signs of surgical anesthesia. However, some physiologic antidote, such as metrazol[6] or coramine,[7] should be at hand for immediate use in addition to the usual oxygen and carbon dioxide. Without these safeguards, no one is justified in giving evipal soluble intravenously. If administered intelligently, there is an extremely wide margin of safety.

Taking as a basis the laboratory experiments and clinical experiences with evipal soluble intravenously in Europe, as well as the observations of a number of American authorities,[8] I determined to test the drug rectally* using rabbits and dogs, but found that rabbits were not good animals for rectal experiments. However, the fact was established that with 5 mg. of morphine per kilogram of body weight and 50 mg. of evipal soluble per kilogram body weight, 7 of 9 rabbits were analgized with no deaths.

The rectal administration of 40 mg. per kg. of dog of evipal soluble in 10 per cent aqueous solution represents the minimal dose that produces surgical anesthesia, resulted in 2 of 3 of the animals being anesthetized for approximately forty minutes. The other dog was hypnotized but

* The laboratory experiments were conducted in the laboratory of the New York University College of Medicine under the supervision of Professor George Barclay Wallace, with the cooperation of Mr. John S. Reinhart who evolved and conducted the technical details.

THE RECTAL ADMINISTRATION OF EVIPAL SOLUBLE IN DOGS*

Dose of Evipal Soluble, Mg. per Kg.	Number Dogs Used	Number Showing Hypnosis	Number Showing Anesthesia	Duration of Anesthesia, Average
25	3	3	0	
30	1	1	0	
40	3	1	2	41 min.
50	6	1	5	1 hr. 14 min.
75	1	0	1	1 hr. 45 min.
100	1	0	1	7 hrs.
125	1	0	1	10 hrs. 5 min.
150	1	0	1	18 hrs. 45 min.
175	1	0	1	17 hrs.

* Each animal received a dose of 5 mg. per kg. of morphine hydrochloride subcutaneously one hour before the administration of evipal soluble.

not anesthetized. A dose of 50 mg. per kg. produced an excellent surgical anesthesia averaging one hour and fourteen minutes in 5 of 6 dogs. There was complete muscular relaxation within three minutes after the rectal instillation and surgical anesthesia was accomplished with no visible impairment of respiration or heart action. The rectal administration of 175 mg. per kg. of evipal soluble produced surgical anesthesia for seventeen hours with full recovery and no after effects. It is, therefore, evident that the margin of safety for evipal soluble administered rectally in dogs is very great, even when preceeded by a hypodermic injection of morphine. The therapeutic index is over 4.0 (minimal lethal dose divided by the minimal anesthetic dose). Administered intravenously to dogs, the index is 3.3, thus showing a much wider margin of safety when the drug is given rectally and also, and more important, a very much longer anesthesia.

With the above laboratory experiments as a foundation, we have clinically tested evipal soluble per rectum in a little over 150 cases, using it *only* for preanesthetic medication. The supplemental anesthetic in my cases was ethylene and oxygen with open mask,[9] the oxygen ranging from 10 to 75 per cent. However, it may be supplemented by other anesthetics. The results have been entirely satisfactory; pulse, respiration and blood pressure remained normal, except as influenced by the necessary manipulations of the surgeon.

In estimating the amount of evipal soluble to use intravenously, the general rule is: Multiply the body weight in pounds by 0.06 c.c., which determines the maximum amount in cubic centimeters of the 10 per cent solution to be injected. For instance, a patient weighing 150 pounds would receive 9 c.c. (150 multiplied by 0.06 of the 10 per cent solution) as the maximum amount intravenously. The first portion is injected at the rate of 1 c.c. every ten seconds, or until the patient stops counting aloud. The remainder is injected more slowly, 1 c.c. every fifteen seconds. If the intravenous injections is slower than this rate, anesthesia may not ensue as the drug is very quickly detoxicated in the body. If the drug is given too quickly, respiratory arrest may occur, which is alarming but not usually fatal.

When evipal soluble is given rectally, as a preanesthetic medication we use as our index 0.2 c.c., that is, a patient weighing 150 pounds would receive 30 c.c. (150 multiplied by 0.2) of a 10 per cent aqueous solution of evipal soluble. In addition, we always add ¼ grain of morphine to the solution. The patient is usually asleep within five minutes after the solution is instilled into the rectum. There is no rectal irritation.

The dose is also determined by the age, conditions, habits and state of health, as well as by body weight. A man or woman accustomed to alcoholic drinks or vigorous exercise would require the full amount or even more than the index demands. Athletic alcoholics have received 30 c.c. of evipal soluble solution rectally with little or no appreciable effect. An anemic, undernourished individual should receive just a little less. A rectal dose of 30 c.c. will produce quiet sleep in over 80 per cent of the cases; in the others, a restful disposition. In either case, supplemental anesthesia, inhalation, local or spinal, will be needed to complete the narcosis for a major operation. This preanesthetic medication may be complete without a supplement for such operations as opening an abscess, setting a fracture, reducing a dislocation, etc.

Relaxation is better following evipal soluble than with any other preanesthetic medication at our disposal. When properly supplemented, the relaxation of muscles is equivalent to spinal anesthesia. It is safer because its action is controllable and reversible with metrazol and carbon dioxide and oxygen at all times. As evipal soluble per rectum effects only the sensory nerves and has no effect whatever upon the heart, it is an unusually safe basal anesthetic. We have never had to use either metrazol or carbon dioxide and oxygen, even when the amount far exceeded the standard dose of 0.2 c.c. per pound. No other barbiturate should be used in association with or prior to evipal soluble. The sleep induced with the stipulated amount per rectum never requires the presence of an anesthetist, as there is no falling back of the tongue or jaw. The drug can be given by any trained nurse in the patient's own bed. We know of no contraindication for its use.

The technic is simpler and easier than with oil-ether per rectum. The patient should have a sodium bicarbonate enema

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March, 1936

Operation	Weight	Age	Amount Rectal Evipal Soluble, Grams	Sleeping after Evipal, Minutes	Supplemental Medication in Evipal Soluble	Terminal Anesthetic	Blood Pressure		Relaxation	Postoperative Nausea	Remarks
							Preoperative	Postoperative			
Thyroidectomy.....	122	43	2.5	10	Magendie solution m.vii.	$N_2O + O_2$	136/76		Very good	None	Reacted on reaching ward.
Plastic of neck (2 hours).....	142	21	3	9	Dilaudid gr. 1/48	$C_2H_4 + O_2$	150/100	128/90	Very good	None	Reacted in 1 hour, restless.
Thyroidectomy.....	138	25	2.5	10	Magendie solution m.vii	$C_2H_4 + O_2$ + ether	118/80	126/78	Not satisfactory without small amount ether vapor	Yes	Reacted in 55 minutes, restless.
Cholecystectomy.....	140	43	3	8	Dilaudid gr. 1/48	$C_2H_4 + O_2$ + ether	138/84	130/78	Very good	None	Reacted 5 hours postoperatively, restless.
Abdominal exploratory	110	48	2	6	Dilaudid gr. 1/48	$C_2H_4 + O_2$ + ether	112/68	100/54	Very good	None	Reacted quietly, 1 hour, 50 minutes postoperatively.
Femur, closed reduction.....	100?	85	1	4	Dilaudid gr. 1/48	$C_2H_4 + O_2$	120/60	110/68	Very good	None	Reacted quietly, 2 hours postoperatively.
Thyroidectomy.....	110	45	2	10	Dilaudid gr. 1/48	$C_2H_4 + O_2$	146/105		Very good	None	Reacted 1 hour, 40 minutes postoperatively.
Humerus, closed reduction.....	120?	84	1.5	3	Dilaudid gr. 1/66	None	not	taken	Very good	None	Reacted 2 hours postoperatively, restless.
Thoracotomy.....	140	41	3	18	Dilaudid gr. 1/48	Local	122/78	110/60	Not satisfactory	None	Alcoholic; reacted 1 hour postoperatively.
Thoracotomy.....	114	35	2	6	Dilaudid gr. 1/48	Local	118/72	128/30	Not satisfactory	None	Alcoholic; reacted on table in operating room.

two hours previously, although this is not always necessary. Dissolve 3 gm. of evipal soluble in 30 c.c. of distilled water and then aspirate the calculated dose into a 30 c.c. solution. Replace the needle with an infant catheter that will fit snuggly on the end of the syringe. With the patient comfortably placed on the left side, lubricate and

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Rectal Evipal

Operation	Weight	Age	Amount Rectal Evipal Soluble, Grams	Sleeping after Evipal, Minutes	Supplemental Medication in Evipal Soluble	Terminal Anesthesia	Blood Pressure		Relaxation	Postoperative Nausea	Remarks
							Preoperative	Postoperative			
Thyroidectomy.....	122	50	2	6	Dilaudid gr. 1/48 gr. 1/96	Ether vapor 10 minutes only	122/60	110/62	Very good	Vomited twice after fluids were given	Reacted quietly 3½ hrs. postoperatively. (Ether used at surgeon's request.)
Thyroidectomy.....	148	16	3	9	Dilaudid gr. 1/48 gr. 1/96	Ether vapor	146/60	140/66	Very good	Vomited once after fluids were given	Reacted 4 hours postoperatively, restless. (Ether used at surgeon's request.)
Cholecystectomy and appendectomy.....	142	49	2.5	8	Dilaudid gr. 1/48	$N_2O + O_2$ + light ether vapor	152/80	138/82	Very good	None first 24 hours	Reacted 6 hours postoperatively, restless.
Incision and drainage of rectroperitoneal abscess.....	100	25	2	12	Dilaudid gr. 1/96	Local	100/56	100/62	Very good	None	Reacted 2½ hours, postoperatively.
Closed reduction of left femur, spica.....	170	50	3	10	Magendie solution m.VII	None	128/84	114/84	Very good	None	Reacted quietly 1 hour postoperatively.
Closed reduction, left femur.....	160	76	2	11	Magendie solution m.VII	None	122/60	112/66	Satisfactory	None	Opened eyes, talked postoperatively. No complaints 9 hours postoperatively.
Incision and drainage of rectal abscess..	31	3	0.6	3	None	$C_2H_4 + O_2$	112/70	90/72	Satisfactory	None	Pulse 152 preoperatively. Pulse 144 postoperatively. Reacted 1½ hours.
Encephalgraphy*.....	36½	6	0.7	3	None	None	100/72	92/68	Very good	None	

* Operation to determine nature of lesion causing Jacksonian convulsions, duration 2 hours, 20 minutes. Anesthesia did not appear to affect normal reaction when spinal fluid was withdrawn and air injected. That is, after 20 c.c. of spinal fluid had been withdrawn and 20 c.c. air injected, the pulse volume would fall off with each succeeding 5 c.c. withdrawal, but volume promptly returned following 5 minutes pause. 60 c.c. spinal fluid removed. Reacted 3 hours postoperatively, somewhat restless.

glass syringe with needle attached. Dissolve ¼ grain of morphine in a small amount of water and aspirate this solution into the syringe with the evipal soluble insert the catheter about 4 inches into the rectum and inject the complete solution rapidly. Instill into the rectum an additional 10 c.c. or more of water. Clamp the

CITY HOSPITAL, WELFARE ISLAND, NEW YORK CITY*

Operation	Weight	Age	Amount Rectal Evipal Soluble, Gm.	Sleeping after Evipal, Min.	Supplemental Medication	Terminal Anesthetic	Blood Pressure		Relaxation	Postoperative Nausea	Remarks
							Preoperative	Postoperative			
Thoracotomy.....	130?	36	3	6	Dilaudid gr. 1/24	Local	100/62	90/48	Very good	None	Reacted quietly. 2½ hours postoperatively.
Rectal fistulectomy...	128	35	2	8	Dilaudid gr. 1/24	N_2O	128/80	120/80	Very good	Vomited twice	Reacted quietly, six hours.
Thoracotomy.....	120?	40	2	4	Dilaudid gr. 1/24	Local. Ethylene and O_2	140/100	120/74	Very good	None	Reacted 4½ hours, restless.
Exploratory laparotomy for carcinoma of gastro-intestinal tract.....	126½	60	2	6	Dilaudid gr. 1/48	Ethylene and O_2	108/70	102/60	Very good	None	Reacted 11 hours? restless.
April, 1936											
Cholecystectomy	144½	44	2½	5	Dilaudid gr. 1/24	Ethylene and O_2 + small amount ether	128/80	120/70	Excellent	None	Reacted quietly, 4 hours. Previous operation under ether was nauseated. High praise for evipal.
Mastoidectomy.....	92	15	1	12	Dilaudid gr. 1/66	$N_2O + O_2$	110/40	116/34	Very good	None	Reacted quietly, 3 hours postoperatively.
Cholecystectomy—Left inguinal herniorrhaphy.....	126	55	2	8	Dilaudid gr. 1/24	$N_2O + O_2$ small amount ether vapor	118/70	120/76	Very good	None	Reacted 50 minutes postoperatively, restless.
Intestinal resection...	119	36	2	6	Morphine sulphate gr. 1/4 Dilaudid gr. 1/66	Ethylene + O_2	128/80	140/80 (Infusion)	Excellent	Vomited once	Infusion during operation. Duration 2½ hours. Reacted quietly, 4 hours.
Mastoidectomy bilateral.....	30	6	9/10	2	Morphine sulphate gr. 1/12	Ethylene O_2 (Skin incision and closure)	100/60	90/50	Very good	None	Reacted quietly 15 minutes post operatively. Child very ill. Preoperative temperature 104°, pulse, 140, R, 36. Recovering from pneumonia.
Cauterization of granuloma of lips.....	120	33	2½	6	Dilaudid gr. 1/24	None	112/70	90/60	Excellent	None	Reacted 7 hours postoperatively, restless.
Gastroenterostomy for carcinoma	115	68	1	12	Dilaudid gr. 1/24	Ethylene and O_2 + small amount ether	110/60	100/60	Very good	None	Reacted 5½ hours, somewhat restless.
Rib resection for empyema.....	30	6	9/10	5	Dilaudid gr. 1/66	Ethylene and O_2	90/40	90/50	Fair	None	Child extremely ill. Operated 7 days previously for bilateral mastoid. Reacted in operating room.
Herniorrhaphy.....	138	38	2½	6	Dilaudid gr. 1/24	Ethylene and O_2	138/80	140/70	Very good	None	Reacted quietly, 2½ hours postoperatively.

* Charts by E. R. Plumb, Anesthetist.

catheter and wait until the patient is asleep, which usually takes about five minutes.

Over 80 per cent of all surgeons give some form of preanesthetic medication. It should be more generally known than it is, that psychic influences are not destroyed by 1/8, 1/6 or 1/4 grain of morphine alone since the systolic blood pressure with this medication often goes up 40 mm. to 90 mm. just prior to the administration of the anesthetic on the table.[10] Wallace and Gwathmey proved in the laboratory that with preanesthetic medication complete anesthesia is obtained with 87 c.c. of ether solution given intravenously in 6 per cent normal saline as compared to 134 c.c. when preanesthetic medication is omitted. They also showed that to produce respiratory failure 245 c.c. of ether solution with preanesthetic medication was required, whereas only 99 c.c. caused such failure when no preanesthetic medication was used. Hooper and Gwathmey[11] demonstrated in the laboratory that with any of the customary inhalation anesthetics the animals which had received preanesthetic medication survived over twice as long as the others which had not been treated in this manner. All of the animals received the same amount of the anesthetic. Furthermore, it was shown at necropsy that lung lesions occur in animals not subjected to preanesthetic medication. Gross examination disclosed distention, edema and congestion; microscopically, perivascular edema, diffused petechia, alveolar spaces filled with fluid and bronchi filled with edematous fluid. The lungs of the animals receiving preanesthetic medication were relatively normal.

SUMMARY

1. Since using dilaudid there has been no occurrence of nausea and vomiting, as compared to 16 per cent of the patients who were nauseated when morphine hydrochloride was used.

2. The index of 0.2 c.c. per pound body weighed holds good for all ages. The youngest patient was three years of age, and weighed thirty pounds, received 6 c.c. of a 10 per cent solution of evipal soluble, which was entirely satisfactory. The oldest patient who was eighty-five years of age and weighed 150 pounds, received 3 gm. or 30 c.c. of a 10 per cent solution.

3. Rectal evipal soluble given in the patient's own bed abolishes mental fear as well as physical pain.

4. Both laboratory and clinical experience demonstrate the value of safe preanesthetic medication. Rectal administration of evipal soluble in the dosage stated makes inhalation, local or spinal anesthesia safer for the patient and easier for the surgeon. Evipal soluble may be given rectally in cases in which intravenous anesthesia is contraindicated because of the fear aroused in nervous patients or the difficulty encountered in entering a vein as in children and obese individuals.

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ELECTROSURGICAL OBLITERATION OF GALL BLADDER WITHOUT DRAINAGE

AS A MEANS OF REDUCING MORTALITY*

(Report of 201 consecutive unselected cases)

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AN unbiased survey of the literature shows that in selected, uncomplicated cases the removal of the gall bladder with the scalpel yields a mortality of 1 or 2 per cent and in the hands of those not especially trained, particularly in patients over forty years of age with coexistent hepatic and cardio-renal disease, the mortality is 10 per cent or even higher. This holds as true today as it did a few decades ago. In 1923, Enderlen and Hotz[1] collected 12,144 cases from leading clinics throughout the world and showed a global mortality of 9.28 per cent. Verbrycke[2] quoting Lyons, stated that in the Garfield Memorial Hospital,

TABLE I

MORTALITY STATISTICS IN GALL-BLADDER OPERATIONS FROM 1908–1932

Surgeon	Number of Cases	Year Mortality	Per Cent
1. Cotte, M.	Not given	1908 Males	33
		Females	18
2. Davis, B. B.	563	1921	8.17
3. Enderlen and Hotz	12,144	1923	9.28
4. Brentano	280	1923 Males	36.78
		Females	17.29
5. Villard	131 cholecystostomies	1925 Males	34
		Females	21
6. Duclos	Global mortality	1926 Males	36
		Females	23
7. Boutin	18 cases complicated by perforation	1927 Males	71.43
		Females	27.21
8. Davis, B. B.	160 cases	1928	3.75
9. Cattell, R. B. *Ann. Surg.* 89: 932 (June) 1929	311 cases (complications, 55 cases)	1929 Males	9.1
		Females	6.8
10. Sanders, R. L. *Ann. Surg.* 92: 374 (Sept.) 1930	18 series of cases garnered from the literature totaling 60 cases	1930	15
11. Verbrycke	169 patients operated by 23 surgeons; 1 surgeon in this series had 10 cases; another surgeon in this series had 20 cases.	1927	8.8 28.5 15
12. Tixier, Clavel and Chabannes	11 males	1932 Males	36.38
	149 females	Females	16
13. Thorek	649 cases	1910	
	138 males	to Males	16.8
	511 females	1932 Females	9.4

* From the author's surgical services at the Cook County and American Hospitals and Cook County Graduate School of Medicine, Chicago, Ill.

Washington, D.C., the mortality for biliary surgery by individual operators over a period of two years varied from 1 to 28

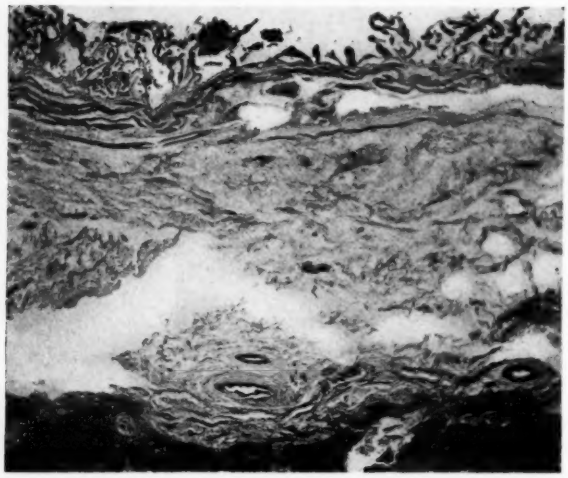

Fig. 1. Bile ducts in the gall-bladder bed; magnified 19 times.

per cent. Mortality advances rapidly with age, in the sixth and seventh decades being more than double that of the fourth decade. It is much greater in males than in females. This is explained by Tixier on an anatomic basis, a narrow configuration of the lower male thorax and consequent inaccessibility of the structures. The subjoined Table 1 furnishes information on the status of mortality at various clinics from 1908 to 1932, inclusive.

It is improper to judge the brilliant results obtained by a few exceptional operators. One must take into cognizance the general results of the average surgeon who does not often report his cases. In view of the aforesaid, one cannot escape the conviction that in many instances an immediate operative mortality may be recorded as high as 20 or 30 per cent or even higher, depending upon the nature of the case and other factors.

What invites fatalities following classical cholecystectomy?

1. In 15 to 25 per cent of individuals there are enlarged bile capillaries and even large sized bile ducts running in the gall-bladder bed (Figs. 1, 2). A removal of the gall bladder with the cold scalpel necessarily opens these bile passages and bile leakage results.

2. Bile, whether sterile or not, has proved to act as a true chemical poison in the peritoneal cavity. Bakeŝ[3] observed bile issuing from the wound 230 times in 346 cases of simple cholecystectomy. He and many other surgeons were impressed by the postoperative appearance of bile in the dressing "in nearly all the cases."

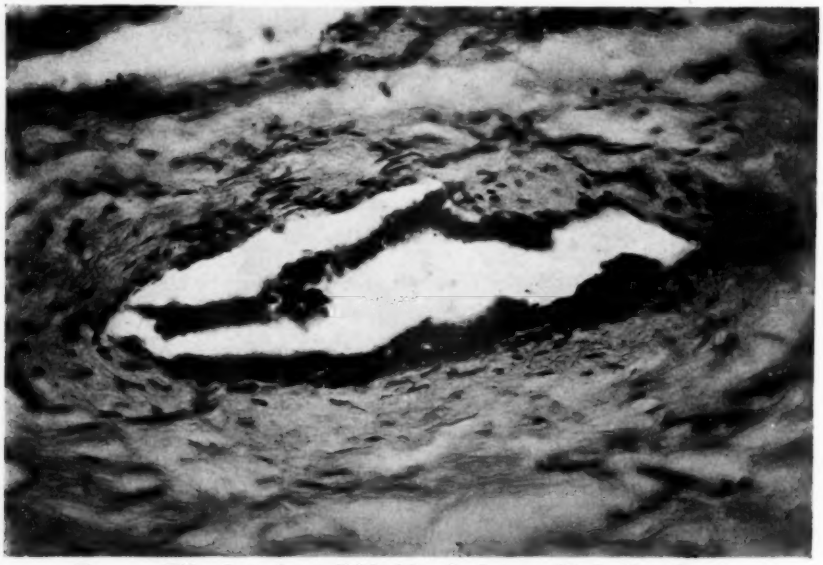

Fig. 2. Bile duct in gall-bladder bed magnified 180 times.

In view of the fact that bile leakage should never occur from a properly ligated cystic duct, it stands to reason that the

unprotected, discharging gall-bladder bed plays the important role in this connection.

3. Furthermore, after classical cholecystectomy the gall-bladder bed cannot always be obliterated by sutures, the resulting raw, rather large open surface is often responsible for bile leakage. Under these conditions resort is made to drainage, but this invites leakage.

Fig. 3. Electrocoagulated gall bladder consisting of a hyaline-like network of inert tissue.

4. The evil effects of drainage are too well known to require discussion other than to mention a few, viz.: augmentation of bile seepage; possibility of thrombosis and embolism; hemorrhage from erosion of vessels; cholemic bleeding and embarrassed cardiac action, particularly in the aged; pneumonia; acute dilatation of the stomach; biliary fistulas, etc. To put it differently many patients die following gall-bladder operations not because they were not drained, but because of drainage. And while the profession is still too much under the thralldom of Kehr's famous dictum that "proper drainage is half a successful gall-bladder operation" it appears, nevertheless, in the light of recent observations, that drainage might also be considered as half an unsuccessful operation.[4] While many of the dangers are eliminated by omitting drains, yet in classical cholecystectomy a drain is often the lesser of two evils and may be the means of saving a life. No less an authority than Lord Moynihan speaks of a "conscience drain," when discussing drainage in this connection.

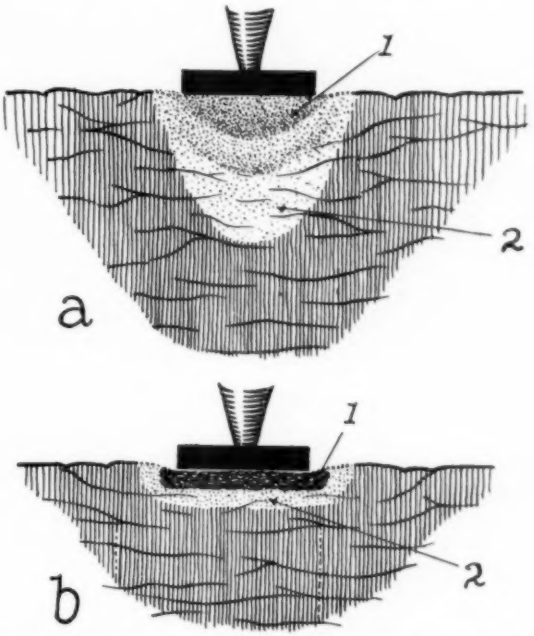

Fig. 4. Diagram of effects of electrocoagulation and of carbonization. In *a* one observes the degree and extent of electrocoagulation when correct technic is used. The dense area immediately under the electrode indicates that here the action is of greatest intensity. It gradually decreases as indicated in the diagram. Marginal action is seen to extend for some distance from the border of the electrode. When improperly used and too much current is applied charring results immediately under the electrode *b*. Such eschar insulates the area acted upon and further effects of coagulation are frustrated.

How can the evils of drainage be avoided?

Experimental studies for a number of years have convinced me that if one could substitute a dry, non-leaking surface instead of a discharging cavity as the gall-bladder bed represents following cholecystectomy, it would be a great step in the right direction. This thought has been brought to fruition by electrocoagulation. It has been shown that electrosurgical

coagulation, properly performed, converts the tissues into a hyaline-like, dry, aseptic, inert tampon. (Fig. 3.) We must emphasize

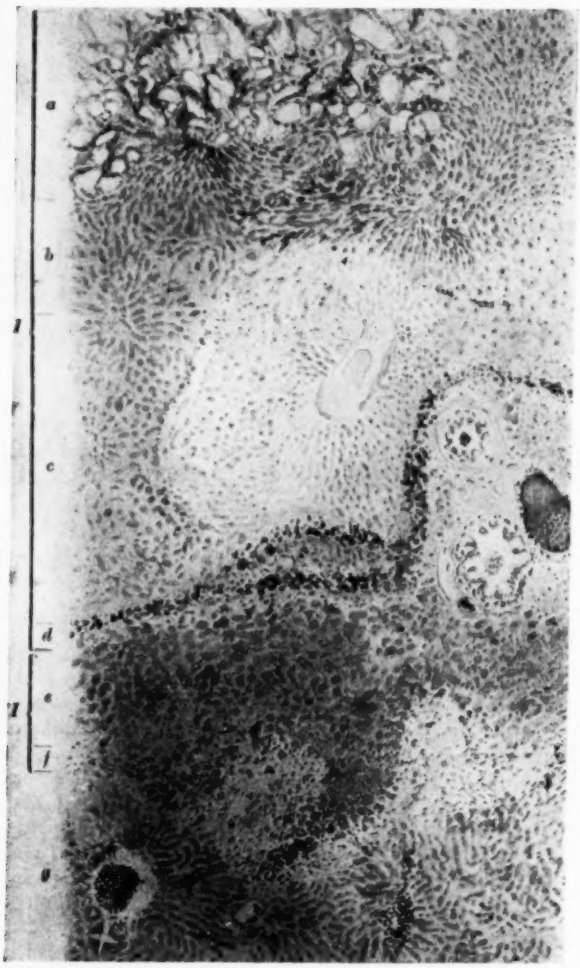

Fig. 5. Effects of electrocoagulation on liver tissue (after Kuntzen and Vogel). First Division: *a.* zone of vacuolation; *b.* zone of palisade cells; *c.* primary zone of necrosis; *d.* primary zone of demarcation. Second Division: *a.* secondary zone of necrosis; *b.* secondary zone of demarcation.

that in order to understand the thesis here presented it is important to have a clear picture of and to understand the differences between *fulguration*, *carbonization* and *coagulation*, terms often used promiscuously and not well understood.

The following throws some light on the genealogy of the terminology under discussion. Monopolar sparking from a high frequency transformer (of Tesla, D'Arsonval, Oudin) was termed sideration by Keating-Hart and electrodissection by Clark and later fulguration by Pozzi. Nagelschmidt introduced the now accepted term diathermy. Bipolar diathermy for surgical purposes was first called voltaiza-

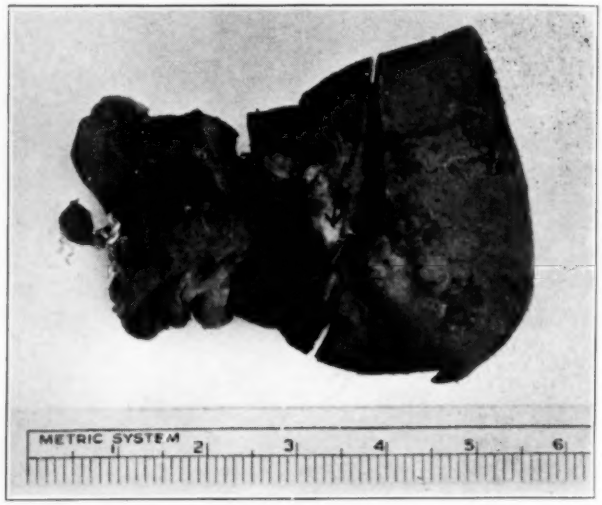

Fig. 6. Electrocoagulation of surface of liver with graft of falciform ligament. Brindle bulldog. Specimen removed seven weeks after operation. An area the circumference of a nickel was electrocoagulated to a depth of about 2 cm. A freely detached portion of the falciform ligament was sutured over it. Note firm union of falciform ligament to electrocoagulated surface of liver. Arrow points to area described.

tion bipolaire and later electrocoagulation by Doyen. Delherme and Laquerriére spoke of endothermy showing that the heat is produced in the patient's body. George Wyeth in 1926, simplified the terminology by coining the terms medical and surgical diathermy. Hanschen speaks of exsiccation, charring, Heitz-Boyer of étincelage á l'intensité, Cushing of dehydration, Kowarchik of electrotomy, von Seemen of "Schmelzschnitt," etc.

To avoid confusion, let it be recalled that if a flat electrode of bipolar current is firmly applied to a tissue surface and a current of proper voltage and sufficient amperage is permitted to pass through it, dehydration and coagulation of the tissue proteins results in a few seconds. This is manifested by the white color assumed by the tissue thus treated. This is called electrocoagulation. On the other hand, if this same electrode is not applied firmly or if used as a unipolar or even bipolar instrument, a small air space, (dielectricum) intervenes between the electrode and tissue

and sparking, fulguration, and carbonization with black discoloration of the tissues results. A reapplication of the electrode to

Fig. 7. Mesentery of guinea pig. Electrocoagulation with small ball-electrode along course of mesenteric vessels followed by subserous injection of India ink of the lymph vessels of the mesentery and wall of bowel. Arrow points to spot of coagulation followed by complete interruption of lymph vessels and spindle shaped narrowing and closure of blood vessels. Note that adjacent lymph vessels not touched by the electrode, remained unaffected. (Zschau.)

such fulgurated or carbonized surface will stop further current penetration and prevent coagulation from taking place (Fig. 4). Also, in cauterization the heat is brought to the tissues from the outside by the heated instrument, while in bipolar electrocoagulation the heat is produced in the patient's body, 75,000 to 3,000,000 or more oscillations per second depending upon the type of apparatus used, (short wave).

Definite tissue changes take place when, for example, the liver is subjected to the electrocoagulating bipolar current. This problem has been solved jointly by Kuntzen and Vogel. The legend of

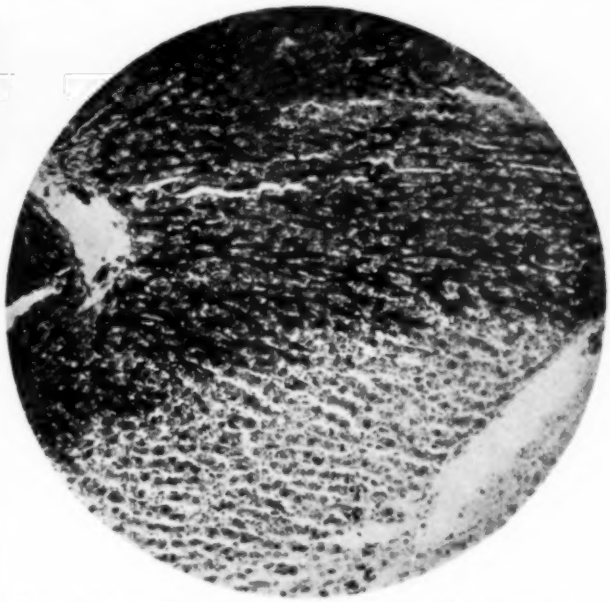

Fig. 8. Liver of guinea pig. Observe line of demarcation between coagulated zone, or coagulating cut, and zone in which blood capillaries are filled with India ink. The blood capillaries remained empty for a distance of 3 mm. Here also the closure of the blood capillaries as in the case of the lymph capillaries is effected not by thrombosis but by coalescence, or coagulation, and junction of the vessel wall. (Zschau.)

Figure 5 briefly describes these changes. It must be stressed that electrocoagulated surfaces within the abdomen do not slough as do surfaces on the exterior of the body where they are eliminated by extrusion. In other words, electrocoagulated tissues on the surface are thrown off, or extruded, while within the abdomen they become encapsulated and are absorbed. Furthermore, electrocoagulated surfaces on parenchymatous organs develop an affinity, a positive chemiotaxis, for serous surfaces attracting contiguous organs covered with serosa, as the bowels, stomach, etc. I have observed agglutination three hours after electrocoagulating the surface of the liver. Firm union takes place in a comparatively short time (Fig. 6).

The capillaries and blood vessels of an electrocoagulated area do not thrombose but a recession of the column of blood

ensues within the vessel, above and below the point of contact of the electrode and the vessel walls coalesce with the contiguous homogenous, hyaline-like structures mentioned (Figs. 7, 8). Such changes do not take place with fulguration or carbonization. Or as Ellis[5] says, "Hemostasis as a result of diathermy does not take place by thrombosis but by collapse and fusion of the walls of the vessels." Aschoff demonstrated that coagulation thrombosis is in sharp contradistinction to true thrombus formation.

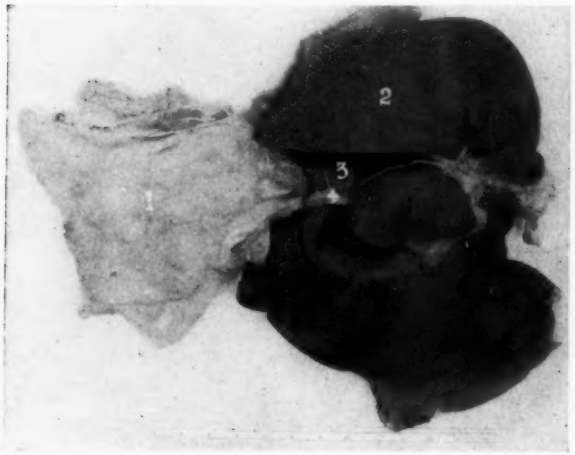

Fig. 9. Results of cholecystelectrocoagulectomy with falciform ligament implantation in a police dog. Specimen removed seven weeks after operation: (1) falciform ligament; (2) lobe of liver; (3) gall-bladder bed; (4) ligated cystic duct and artery. Fine adhesions between falciform ligament and gall-bladder bed; firm union of lower end of falciform ligament with stump of ligated cystic duct.

Another important fact in electrocoagulated tissues as related here is that in the gall-bladder bed secondary hemorrhage does not occur because of the pressure exerted by the sequestrated, coagulated mass against the contiguous tissue.

It will thus be seen that properly executed bipolar electrocoagulation substitutes a secure sterile tampon for an insecure open cavity at the site of the gall-bladder bed.

Evolution of the Author's Method

For some years the experimental animals used in this series of investigations were large dogs, macacus rhesus and macacus leoninus[6,7] and portions of freshly removed gall-bladders at operation. It must be recalled that the absence of pathology in animals as well as anatomic differences, (viz., size and configuration) renders experimentation difficult and at best deductional. Nevertheless, experimental studies have to be done on lower animals before any given method can be tried on humans.

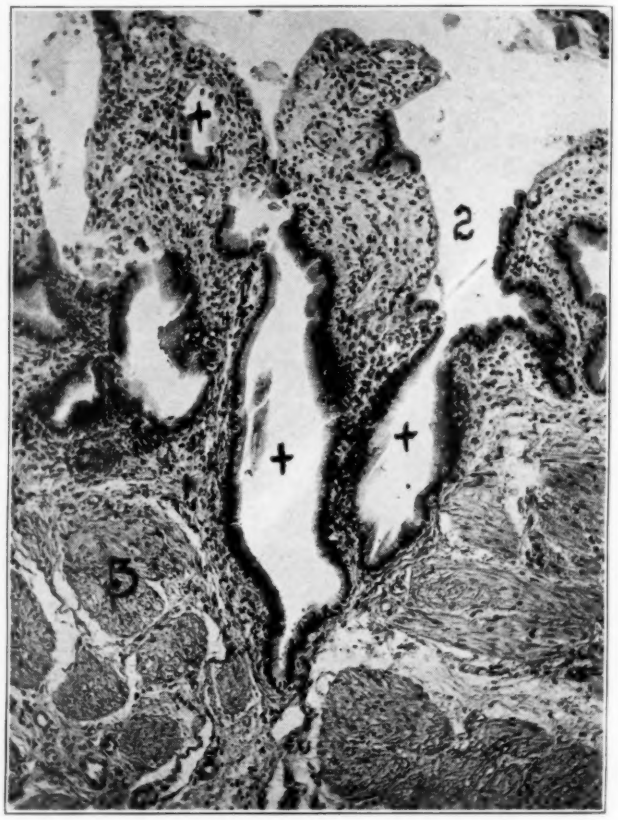

Fig. 10. Chronic cholecystitis, (1) mucosa, (2) Rokitansky-Aschoff sinuses, (3) muscularis.

The results of my experimental studies permitted the following conclusions:

1. The posterior gall-bladder wall and bed of the gall bladder may be effectually electrocoagulated and their structure converted into an inert, dehydrated, hyaline-like, aseptic tissue.

2. Electrocoagulated borders of the gall bladder may be approximated with sutures.

3. The ligamentum falciforme hepatis may be completely detached and when superimposed over an electrocoagulated surface will become intimately united with it (Fig. 9).

4. The abdomen may be closed without drainage provided the cystic duct is securely ligated and the cystic artery closed by double ligation.

Fig. 11. Effects of carbonization on gall bladder with chronic inflammation. Observe portion of Rokitansky-Aschoff sinus, right, persisting. Entire muscularis and serosa unaffected. Large vessel at bottom of section markedly engorged.

Fig. 12. Effects of forced carbonization on wall of inflamed gall bladder; (1) eschar, (2) Rokitansky-Aschoff sinus in transverse section, (3) muscularis and (4) serosa. Note excellent state of preservation of layers of gall bladder past the mucosa.

In 1928, E. H. Trowbridge[9] described electrosurgical cholecystectomy with recovery, and E. Heymann[10] speaking before the Berlin Medical Society in May, 1930, stated that for sometime past he has removed gall bladders by dissecting the gall bladder from its bed as in the classical procedure with the diatherm knife instead of the scalpel and that for some years past he removed also the appendix, portions of the stomach, etc., by the same means.

About the same period a number of others, Keysser et al. and Mirizzi reported that they had performed electrosurgical cholecystectomy with the diatherm knife instead of the scalpel. Drainage was used. It is obvious that the methods these observers resorted to were in no way different from classical cholecystectomy except in substituting the cutting electric current instead of the scalpel, therefore, leaving the gall-bladder bed unprotected. The results were about the same as in classical cholecystectomy.

Stimulated by surgeons who for many years preceded him with the use of the hot iron, in 1928, Pribram[11] used carbonization, at first with the Paquelin burner and a year later with the diatherm apparatus. His object was "carbonization" of the mucous membrane of the gall bladder, this he termed "mucoclasis." He aimed at "burning, charring and carbonization" and not at coagulation. In 1933[12] and even as recently as 1934, Pribram still speaks

of "carbonization." He says "Originally, I used the Paquelin burner to destroy the mucous membrane. This proving ineffective, I used Hadenfeld's hot iron such as is used in Bier's clinics. The burning effect was excellent. In spite of this it did not meet with the desired effects, because: first, the heat introduced into the abdomen was too great; second, the danger of explosion." He then describes a diatherm apparatus designed by Keysser. It is significant that while working with fulguration, Pribram continues to speak of "charring" and "carbonization." He says: "One must not approximate the electrode snugly. One must just barely touch it, and when sparking results, the mucous membrane will be destroyed promptly. Avoid deep penetration."

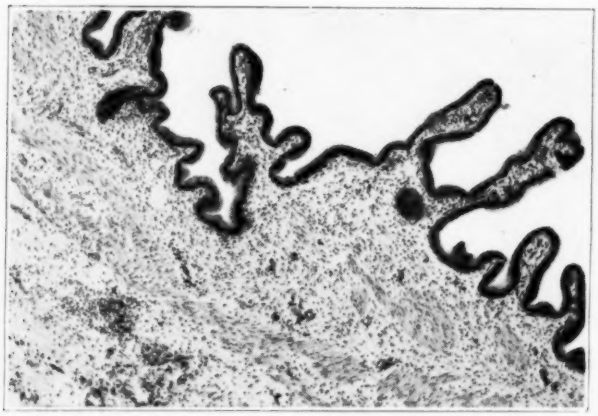

Fig. 13. Reason for failure of mucolasis. Mrs. M. L. Chronic cholecystitis nine months after electrocarbonization of mucous membrane of gall bladder (mucoclasis). No relief of symptoms. Regeneration of mucous membrane and persistence of inflammation (round cell infiltration, and the like). Relieved by electrocoagulation of entire gall-bladder wall. Reduced from a photomicrograph.

It will thus be seen that Pribram's mucoclasis is a fulguration method aiming solely at destruction of the mucous membrane of the gall bladder. It is self evident that this is ineffective to eradicate gall-bladder disease because the charred area prevents the current from reaching the depths of the affected zone in the gall-bladder wall, viz: the Rokitansky-Aschoff sinuses (Luschka's glands) which harbor infection. (Figs. 10, 11 and 12.) Besides it has been shown by Schmiedheiny[13] and others that gall-bladder infections often transgress all layers of the gall-bladder wall, the gall-bladder bed and extend to various depths into the liver substance. The futility of simple fulguration of the mucosa of the gall bladder in such cases even when extensive is obvious.

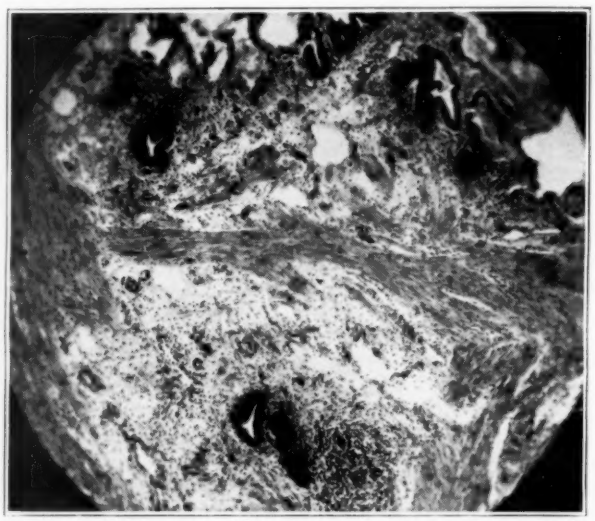

Fig. 14. Reason for failure of mucoclasis. Mrs. A. M. Chronic cholecystitis eight months after (mucoclasis) electrocarbonization of the mucosa. Note remnants of Rokitansky-Aschoff sinuses and diffuse round cell infiltration. Below in center of field, an aggregation of polymorphonuclear leukocytes. Reduced from a photomicrograph with a magnification of 105 diameters. Persistence of symptoms. Relieved by total obliteration of gall-bladder wall by electrocoagulation.

In view of the good results reported by Pribram, I used his method on a number of patients. After some time, I found that patients thus operated were not relieved of their symptoms and presented themselves for reoperation. At such interventions the opportunity was offered to see what transpired following the use of the Pribram method with fulguration with both cautery and diathermy. There was regeneration of the mucous membrane of the gall-bladder mucosa and the diseased layers of the gall bladder were little or not affected at all. The infection persisted. (Figs. 13 and 14.) It appeared to me at that time that if the entire gall-bladder wall could be destroyed a further step in

the right direction could be taken, and this was proved, as will be shown. Later, Albertin[14] has shown that Pribram lost that he lost 3 of 16 patients, a mortality of 18.75 per cent. Also, Whitaker's disregard of the important conclusions of

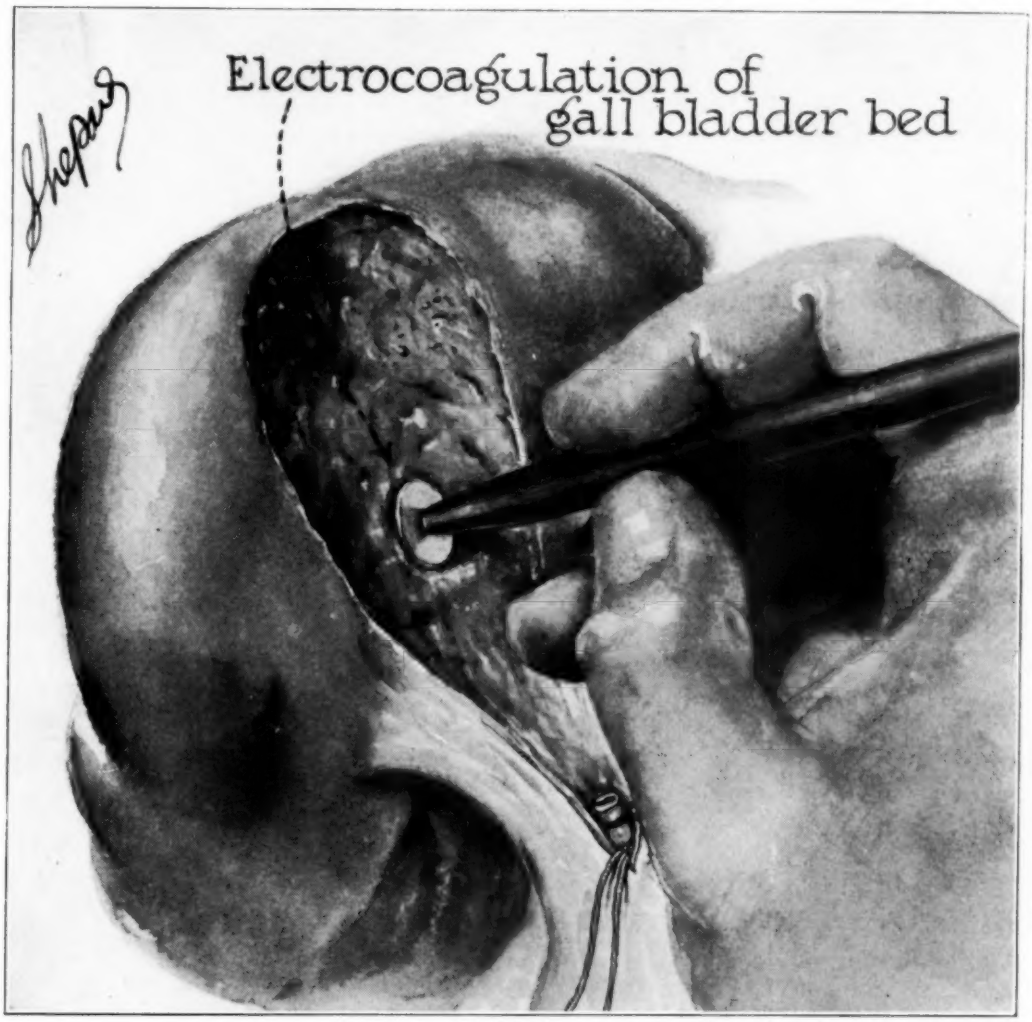

Fig. 15. Electrosurgical cholecystectomy, Phase 1.

This method done with the electrosurgical knife is the same as scalpel cholecystectomy and *has not yielded any better results than classical method.* If accompanied with drainage the results are much worse than classical cholecystectomy, (see Whitaker's results) and therefore should not be used.

9 patients in a series of 310 cases in which he used his method of mucoclasis.

Others attempted to use a combination of methods with disappointing results. In 1930, some years after Trowbridge, Heymann and Pribram reported their methods of electrosurgical cholecystectomy and gave them a trial, L. S. Whitaker[15] also used the cutting current in removing the gall bladder. Later, he[16] disregarded the admonition of Pribram and drained his patients thus treated with the result

such eminent workers as Pribram, Wyeth, Cushing, Clark, Heitz-Boyer, v. Seemens, Doyen, Pauchet, Ward, Kelly, Zschau, Kuntzen, Keysser, Vogel and a host of others on the effects of the different currents to which Whitaker refers as "hair-splitting," contributed greatly to his discouraging results. (Figs. 15 and 16.)

Based on my researches and clinical studies a procedure was evolved, the underlying principles of which consist of: (1) biterminal electrosurgical obliteration of

the posterior gall-bladder wall and bed by electrocoagulation; thus substituting a sterile, dehydrated tampon for a bleeding, gall-bladder pathology. There was one death (Case No. 149). Postmortem examination showed that the patient died

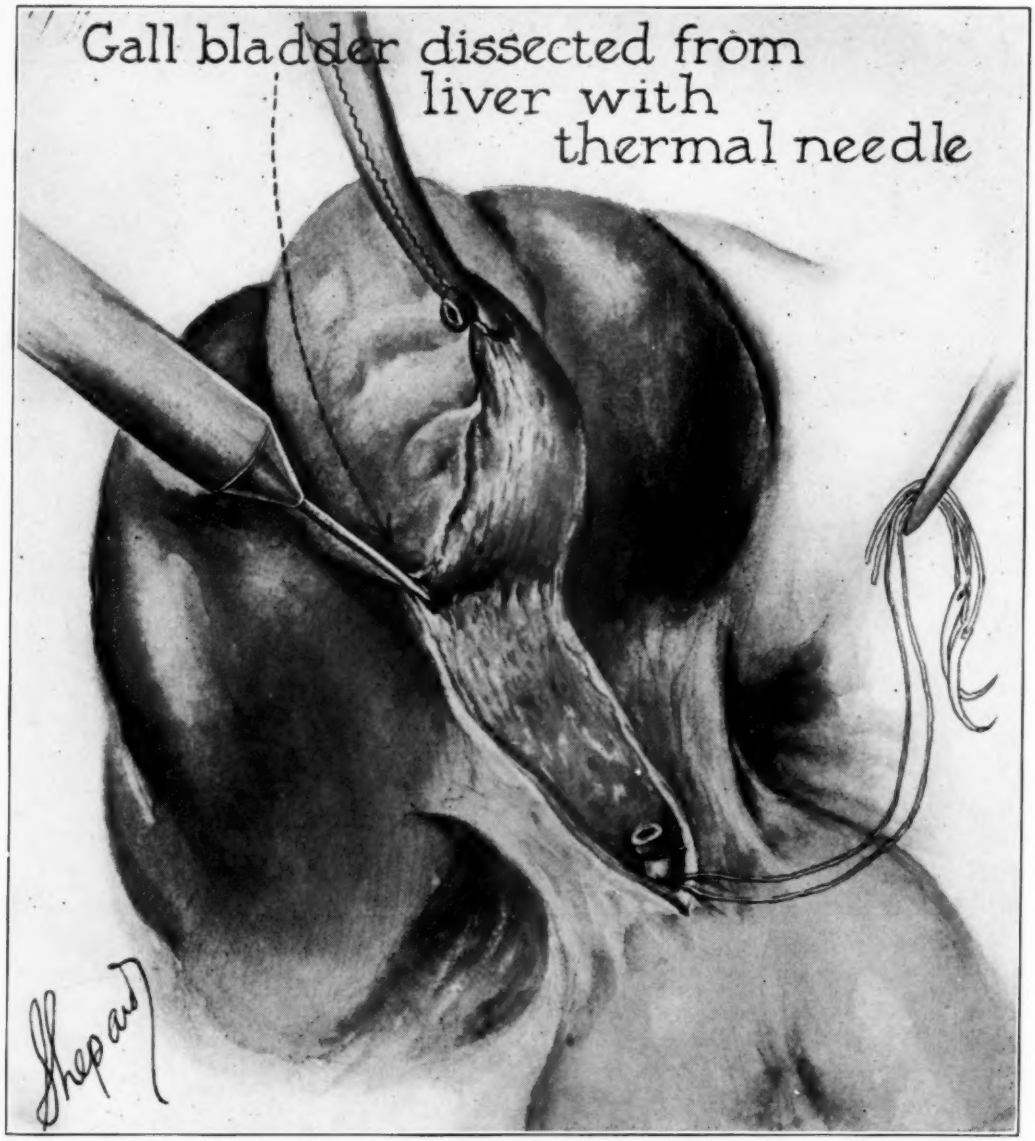

Fig. 16. Electrosurgical cholecystectomy, Phase 2, *not recommended.*

bile leaking surface; (2) the great tendency of electrocoagulated surfaces to become agglutinated with serous surfaces caused me to muster the falciform ligament into service; (3) strict avoidance of drainage.

Up to the present writing, April, 1936, I have performed this operation, termed "cholecystelectrocoagulectomy," in 181 consecutive, unselected cases of gall-bladder disease including gangrenous, empyematous, sclerosed and other forms of from causes unrelated to the operation (Table II). In a personal communication dated Dec. 31, 1935, from Kellogg of the New York Post-Graduate Hospital he states that he used my method in 16 cases without a death, while Finlayson operated on 4 patients with good results. This brings the total operations performed to 201 cases.

Whether my procedure alone or the painstaking pre- and postoperative care of patients or both contributed to these

results, I am unable to say. Yet, I am fully cognizant of the occasional occurrence of a so-called "liver death" following classical cholecystectomy.

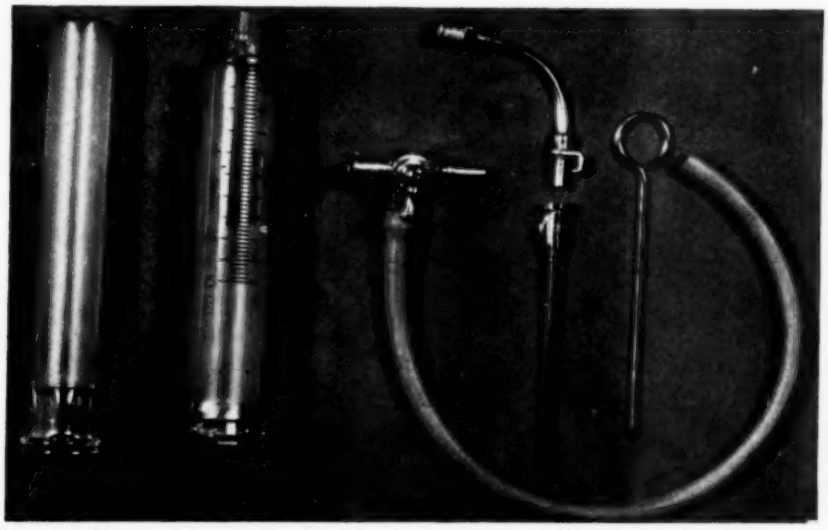

FIG. 17. Component parts of author's two-way gall-bladder aspirating syringe.

TECHNIC

Thorough preoperative preparation of the patient is a imperative.

Step 1. Wherever possible subarachnoid block is the anesthetic of choice, otherwise inhalation anesthesia is chosen. The patient is placed in the Mayo-Robson position with the lower thorax and upper abdomen sufficiently elevated. A large, flat, indifferent electrode is snugly applied over the sacrum. Preferably a simple, median longitudinal pararectus incision is made beginning at the xiphoid and extending to about the level of the umbilicus. Exposure must be thorough.

Step 2. Mobilization of the falciform ligament. This structure is completely detached from its moorings to the anterior abdominal wall with the exception that it is permitted to remain attached temporarily by a narrow pedicle and is packed out of the way by warm laparatomy sponges. In detaching the falciform ligament from the anterior abdominal wall, some small vessels are severed; these must be carefully ligated. Pack the viscera out of the way and obtain good exposure by efficient retraction.

Step 3. The biliary passages are explored and the gall bladder is aspirated, using an especially designed aspirator (Figs. 17 and 18) which permits evacuation of the gall-bladder contents into a receptacle via a rubber tube. After aspirating its contents, the gall bladder is filled with hexylresorcinol (S.T. 37) or 3 per cent iodine solution. Only about 5 per cent of bile contains microorganisms while their presence in the gall-bladder walls may be demonstrated in over 70 per cent of cases. For that reason I introduce an antiseptic into the gall bladder before opening it.

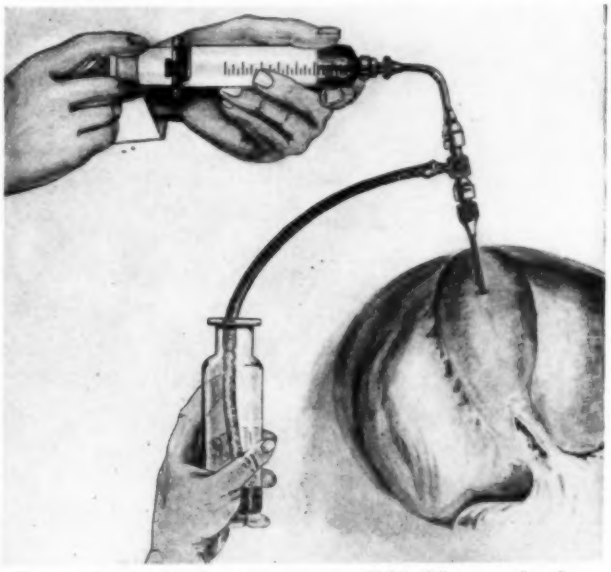

FIG. 18. Author's two-way gall-bladder aspirating syringe in use.

The extrahepatic biliary passages are explored next. The cystic artery and duct are ligated doubly and jointly, cutting both ligatures short. (Figs. 19, 20 and 21.) Experience has taught me not to attempt extensive dissections in searching for the cystic artery if it is not easily isolated, but to splint it with the ligature to the cystic duct. This should be followed particularly in inflammation about the hepatoduodenal ligament. The frequent, abnormal course of the artery should be kept in mind.[17]

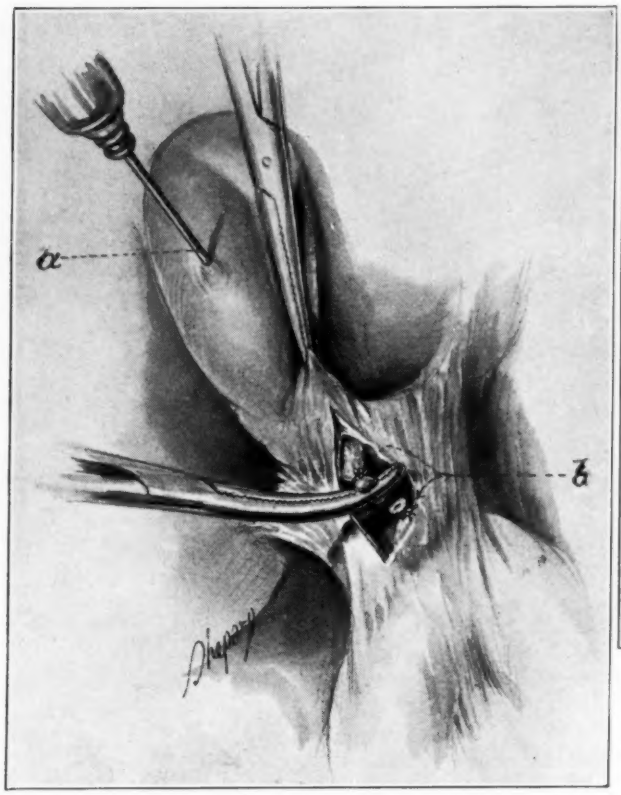

Fig. 19. Aspiration of the gall-bladder; cystic duct and artery have been doubly ligated. The ligatures are cut short.

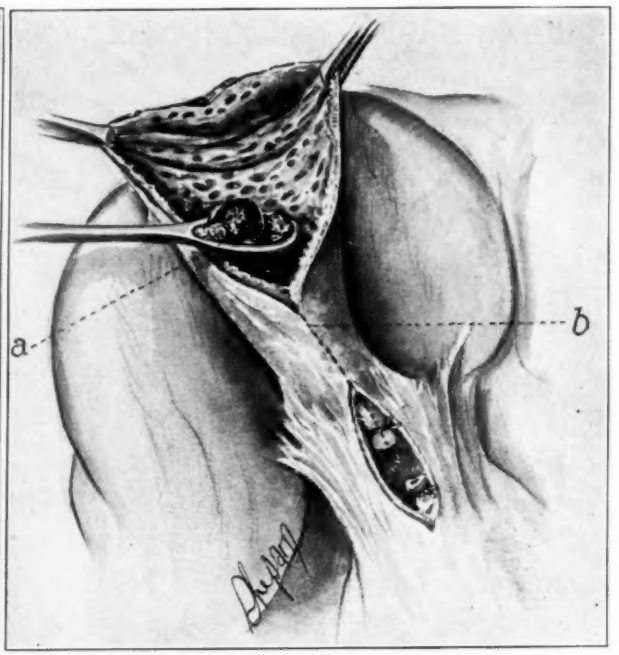

Fig. 20. Gall bladder is opened along its entire length with an ordinary pair of scissors. Electric cutting scissors have been discarded by the author after having proved ineffective. The gall bladder is cleared of its contents.

Step 4. Open the gall bladder and evacuate its contents. A non-spilling gall-bladder content receptacle[18] (Fig. 22) collects the evacuated material without spilling it. Old fashioned gall-bladder spoons are too shallow and offer no protection against contamination from spilled contents. My instrument consists of a cone shaped container measuring 2¼ inches in diameter and 2 inches in depth, mounted on a shaft of suitable size. A close fitting cover is hinged and held open when in use by means of spring friction clips. Slight pressure upon the cover releases it so that the material cannot spill during its removal. The front part of the receptacle is somewhat concave allowing sufficient latitude for proper contact with the subcholecystic structures, and its edges rodded, thus avoiding injury to the liver.

Step 5. Split the gall bladder longitudinally from above downward with an ordinary pair of scissors. Grasp half of the gall-bladder wall with an insulated angiotryptic forceps* (Figs. 23*a* and *b*). In closing the forceps, the gall-bladder wall is crushed and the blood vessels coursing in it are reduced by compression to a mere ribbon (Fig. 24). With a pair of scissors remove the redundant portion of the gall-bladder wall. Tuck a piece of rubber around the angiotryptic forceps holding in its grasp the remaining gall-bladder edge. Apply an electrode (see insert in Fig. 24)

* An ordinary artery forceps sheathed in rubber tubing will act just as well.

along the exposed margin of the gall bladder which is held in the forceps. The current will electrocoagulate it but will

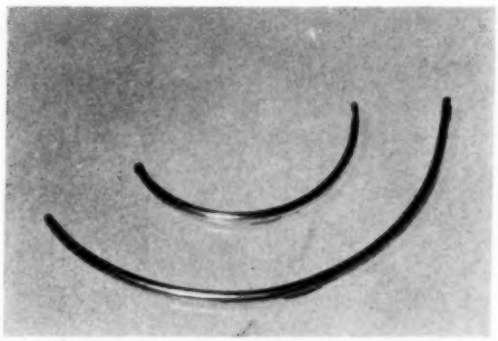

Fig. 21. Needles used by author in operations on the liver and biliary passages. The smallest size is used for ligating the cystic duct and artery; the larger, in emergency operations on the liver. One extremity of the needle is olive pointed, thus avoiding injury to the liver substance.

not pass beyond the insulated part of the angiotryptic forceps. Release the forceps; a compressed coagulated ribbon of tissue remains (Fig. 25). Repeat the procedure the same way all around. Electrocoagulate the remaining portion of the posterior wall of the attached gall bladder, which has not as yet been acted upon. I use a short wave apparatus.

In my early cases I thought it advisable to electrocoagulate slowly but experience has taught that quick, decisive coagulation has yielded the best results. The reasons for this are:

less moisture than tissue coagulated more slowly. Less heat is radiated to the contiguous tissues. Another reason for substituting rapid coagulation with a smaller electrode is that slow coagulation results in heating of the tissues to quite an extent

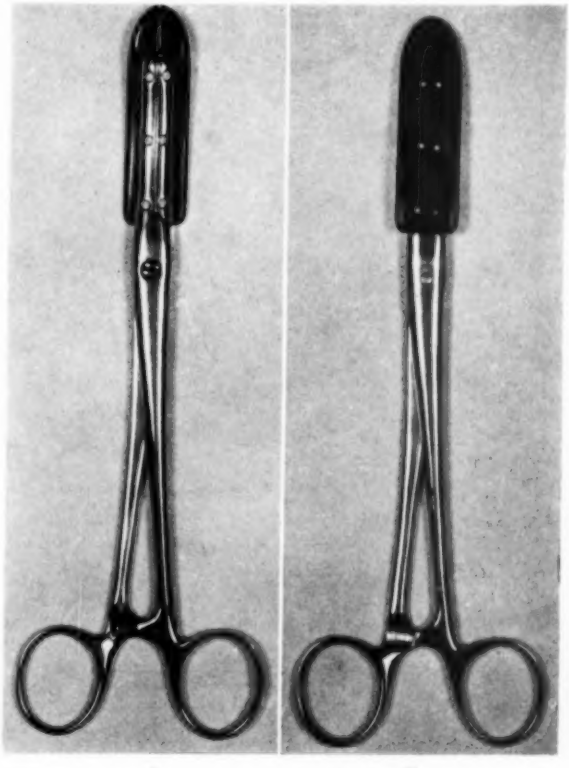

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Fig. 23. Author's angiotryptic forceps. A. front view, B. back view. Ordinary artery forceps sheathed in rubber serves the same purpose.

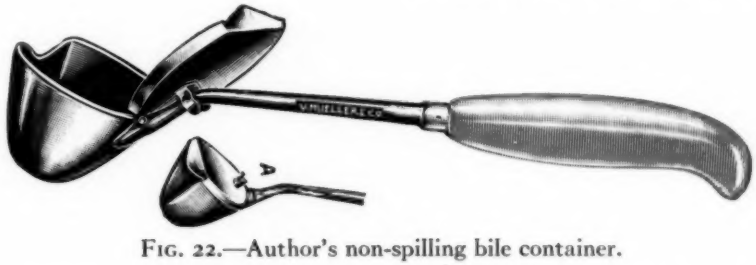

Fig. 22.—Author's non-spilling bile container.

I use a low current voltage and high amperage on a rather moderate sized electrode. On this unit as the voltage drops, the amperage increases. This affords prompt, thorough dehydration and a sharply defined line of demarcation between the coagulated and non-coagulated tissue. Tissue thus coagulated will retain beyond the electrode, about 0.5 cm. to each mm. There is no sharp line of demarcation in slow coagulation; the tissue changes are gradual.

When the diatherm is used the electrode should be applied snugly to avoid carbonization. The current should be turned on only *after* the electrode is firmly applied and

should be shut off before the electrode is removed from the cauterized surface. Avoid fulguration and its attendant carbonization.

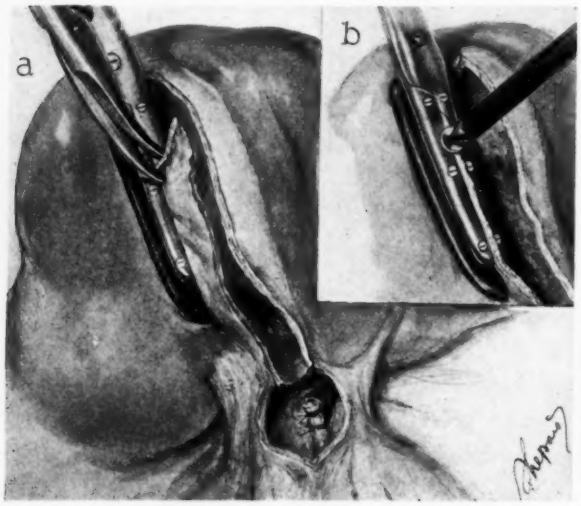

Fig. 24. (a) Opened gall bladder crushed with author's insulated angiotryptic forceps and redundant portion of gall bladder removed with ordinary scissors.

(b) Remaining strip of gall bladder in grasp of forceps being electrocoagulated with short wave current. The current passes through the forceps but not beyond insulated protector.

It will defeat the purpose of the operation. Any bleeding from the branches of the cystic artery is controlled by grasping the vessel and touching the artery forceps holding it with the electrode. Hemostasis will promptly result (Ward's procedure).

There is now an area represented by the electrocoagulated posterior wall of the gall bladder attached to the gall-bladder bed and the rest of the gall bladder not treated (Fig. 25).

Step 6. Approximate the electrocoagulated edges of the gall bladder by a few interrupted sutures (Fig. 26).

Step 7. Some peroxide of hydrogen on a sponge is applied to the gall-bladder bed area. The falciform ligament which it will be remembered is still in the abdominal cavity attached by a narrow pedicle is delivered, the pedicle grasped with an artery forceps, a ligature thrown around it below the forceps and the ligament detached completely with the scissors. One end of the detached falciform ligament is sutured to the upper end of the united, coagulated gall-bladder bed. The lower third of the ligament is now stitched to the lowermost end of the approximated, electrocoagulated surface and the free end of the ligament is placed, but not sutured against the doubly ligated end of the cystic duct and artery.

Fig. 25.

Fig. 26.

Fig. 25. The insulated angiotryptic forceps are removed leaving ribbon of crushed and electrocoagulated strip of gall-bladder tissue all around gall-bladder bed. The posterior wall of the gall bladder in the middle of this ring is being electrocoagulated.

Fig. 26. Strip of electrocoagulated and crushed ring of tissue of gall bladder united with sutures.

Table II
(Compare This with Table I.)

Total number of cases	201
Males	26
Females	175
Age of patients—youngest	18 years
oldest	74 years
Average high temperature	100°F.
Average number of days in hospital	15.5

Pathologic conditions found at operation: Acute and chronic cholecystitis, cholelithiasis, hydrops vesica fella, empyema of the gall bladder, acute hemorrhagic cholecystitis, hepatitis, adhesions, chronic pancreatitis.

Postoperative complications: None, except in one case in which a cholecystelectrocoagulectomy was done for gangrenous cholecystitis and cholelithiasis. The sutures were removed on the eleventh day. The wound healed by first intention. On the tenth postoperative day symptoms of bilateral pleurisy with effusion were noted, which cleared. The patient left the hospital on the twenty-seventh day in good condition.

Mortality: One death one week after operation, of a female patient fifty years of age. At autopsy a ruptured old subdiaphragmmatic abscess which was not diagnosed before operation was found. The *operative area was clean.*

An effective serous covering is thus formed over the gall-bladder bed and cystic duct (Figs. 27 and 28).

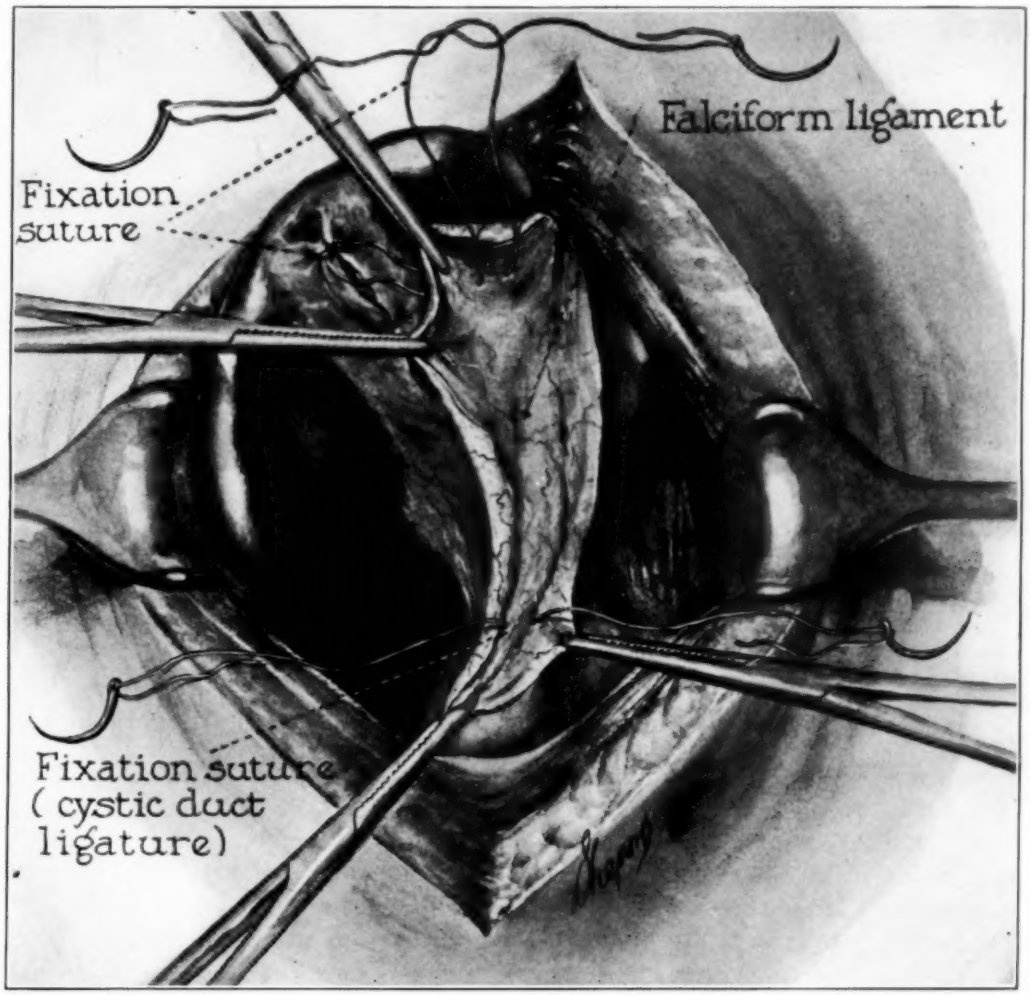

Fig. 27. Note borders of the electrocoagulated area approximated with fixation suture. Additional interrupted sutures of fine catgut approximate the borders of the electrocoagulated zone along its entire extent. The mobilized falciform ligament is fixed over the closed, electrocoagulated surface. Note placement of sutures.

Step 8. The laparotomy packs and retractors are removed; the field of operation is dried and the abdominal wall closed in the usual manner without drainage.

What becomes of the structures in the gall-bladder bed after the operation described? The answer to this has been given based upon animal experimentation. Recently, a postmortem examination was done on a patient who died of acute pulmonary tuberculosis on whom I performed a cholecystelectrocoagulectomy eighteen months prior to her last illness. Figure 29 shows the structure of the implanted falciform ligament. The gall-bladder bed is represented by unaltered cords of liver cells.

CONCLUSIONS

1. A method of electrosurgical obliteration of the gallbladder is described which when carefully followed may be used in simple and complicated cases of gallbladder disease without resorting to drainage. It reduces mortality to a minimum and cuts hospitalization. The much dreaded age factor in these operations loses its terror. Shock is absent.[19]

2. Failures and fatalities in classic cholecystectomy after the operation are frequently due to bile leakage, as a

result of an inability to obliterate and cover the gall-bladder bed, which contains bile capillaries and often larger bile ducts, cause is an indication for cholecystelectrocoagulectomy.

6. Experimental studies have shown

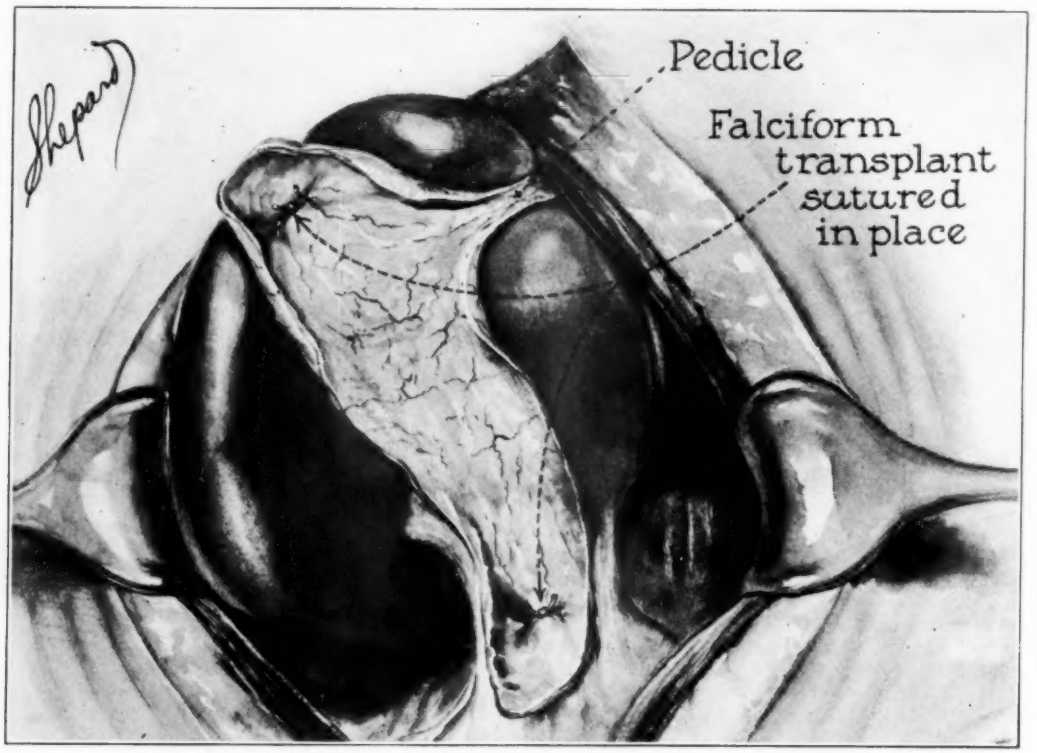

Fig. 28. Appearance of field of operation after completion of final stage.

in 15 to 25 per cent of the cases (Figs. 30 and 31). Drains invite bile seepage.[20] The method described seals these openings by electrocoagulation. A sterile, hyaline, dry protective layer is substituted for a raw, unprotected surface. The falciform ligament is superimposed over this area. Drainage is entirely omitted.

3. The term cholecystelectrocoagulectomy is descriptive of the procedure.

4. The operation here described must not be confused with mucoclasis; practiced with the cautery or diatherm fulguration which aims at burning or carbonization, of the mucous membrane of the gall bladder, or with so-called electrical or "electrocholecystectomy" where, instead of the scalpel, the diatherm cutting knife is used. These are entirely different procedures.

5. A prerequisite to the achievement of satisfactory results is a patent common duct. An occluded cystic duct from any that any method of carbonization, as fulguration, Paquelin and electrocauterization predisposes to hemorrhage, thrombosis and embolism. Such cauterization will not destroy pathogenic microorganisms in the depths of the affected gall-bladder wall. Cholecystelectrocoagulectomy is free from these drawbacks and effectually accomplishes destruction of the entire thickness of the gall-bladder wall and if indicated, also the gall-bladder bed. The surgeon has under control the degree of penetration he wishes to accomplish (Fig. 32). E. L. Whitaker (loc. cit.) states, "The method of Thorek emphasizing contact coagulation to considerable depth seems preferable to fulguration. . . . I am grateful to Thorek for the distinction and wish to emphasize the necessity for real contact coagulation . . . "

7. The ligamentum falciforme hepatis is used as a free graft serosal structure

in covering sutured or raw surfaces to great advantage, thus reinforcing and protecting the areas concerned against

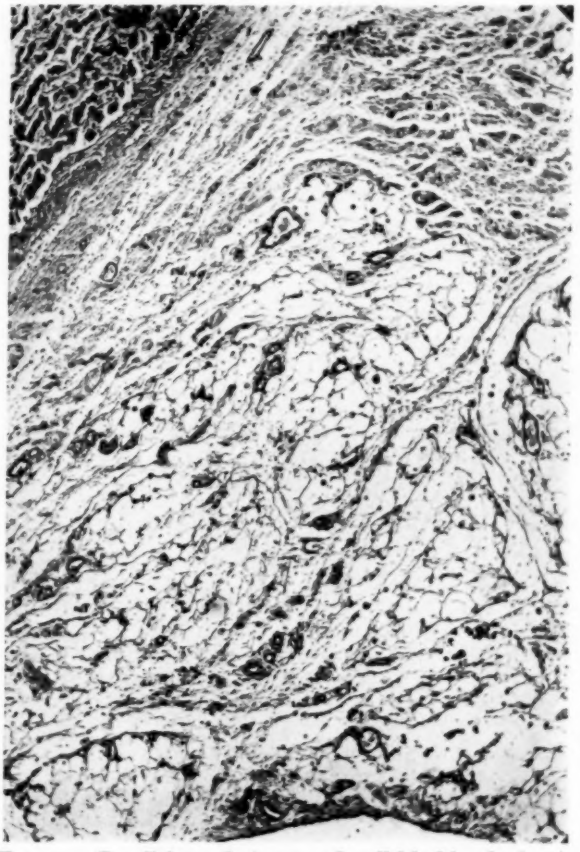

Fig. 29. Condition of tissues of gall-bladder bed one and one-half years after author's operation (low magnification). Observe histologically normal section of liver. All that remains of the gall-bladder bed is a strip of connective tissue. The falciform ligament shows its characteristic normal structure.

seepage and safeguarding the processes of repair.

8. Electrocoagulated areas of intra-abdominal organs tend to heal by encapsulation. They do not interfere with wound healing. On the contrary, they heal promptly when the wound is closed securely. Therefore, drainage is not only undesirable but is distinctly deleterious. Many patients succumb because of drainage. It prolongs the healing process and predisposes to infection. Cholecystelectrocoagulectomy eliminates the necessity of drainage and its unpleasant sequelae.

9. The thesis here presented deals with diseases of the gall bladder. Concomitant affections of the extrahepatic biliary passages will be the subject of an article to follow. It must be stated, however, that where choledochostomy or hepaticostomy is indicated, these may be done, in conjunction with the author's procedure. Experimental studies showed that the implanted falciform ligament over the obliterated gall-bladder bed forms sufficient protection and does not interfere with a Kehr or Orr tube.

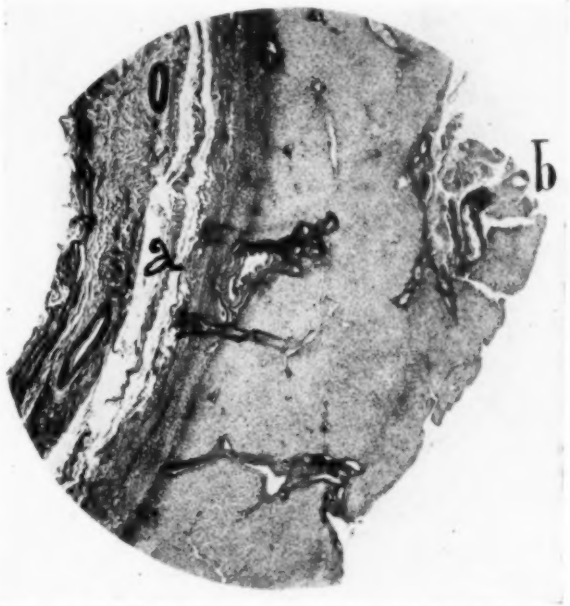

Fig. 30. Gall bladder removed elsewhere by classical cholecystectomy. Note large portion of liver tissue included with the gall bladder. (a) The latter, it is stated, could not be separated from the liver on account of extensive adhesions between liver and gall-bladder bed (magnified 25 diameters). Note dilated bile ducts (b) extending to the torn surface of the liver.

10. Inasmuch as the global mortality of removal of the gall bladder by the scalpel method in complicated cases still ranges somewhere between 8 and 10 per cent or more, it stands to reason that if, as in the series of cases here reported, cholecystelectrocoagulectomy promises to reduce the mortality in unselected cases, barring unforeseen accidents such as result from anesthesia, precipitate hepatic insufficiency, etc., to near the zero point, the effort of acquiring an exact technic for its performance, it will be agreed, is truly worth while.

11. The authoritative report of E. L. Kellogg of having used my method in 16 cases and that of Finlayson in 4 cases

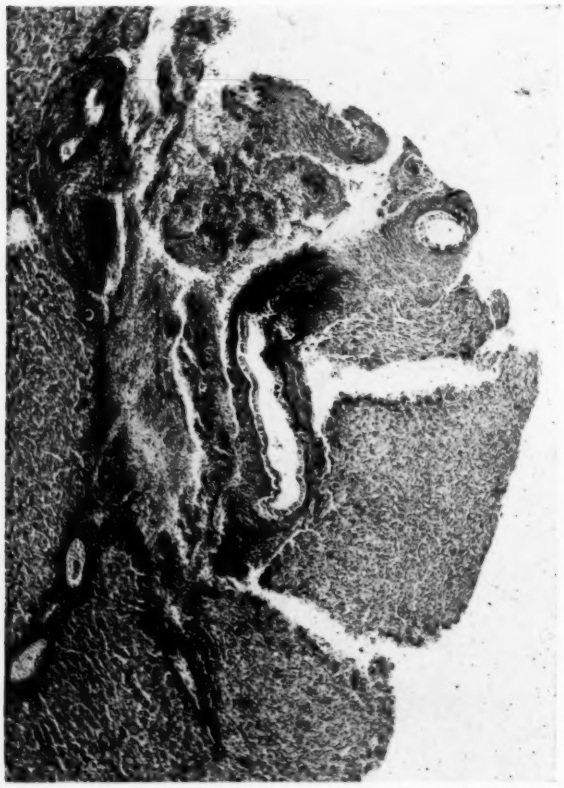

Fig. 31. Same as preceding (magnified 95 diameters) extending to the surface of the torn liver edge. Classical cholecystectomy elsewhere. Death 5 days after operation.

without a fatality, is gratifying.

12. Electrosurgical or electrocholecystectomy, so-called, is nothing more than classical cholecystectomy where the electric cutting knife is substituted for the scalpel. It has contributed nothing to the improvement of the old method and has added the danger of explosion by sparking or fulguration. Furthermore, if coupled with drainage as practiced by Whitaker more drawbacks are added in the form of increased mortality of 18.75 per cent (loc. cit.).

13. Many decades ago attempts were made to destroy the gall bladder by carbolic acid and other escharotic substances. This is an antiquated procedure and quite ineffective, acting only superficially, demanding prolonged periods of drainage and often leading to fistulization.

14. Meticulous technic and a thorough understanding of the principles involved in the procedure are essential to the

Fig. 32. Effects obtained from bipolar electrocoagulation of muscular tissue. Note smooth action and degree of coagulation produced at will. Observe depth of penetration in upper specimen without carbonization and sagittal section of electrocoagulated area in the lower specimen. Note degree of penetration and marginal action of current. A strand of fascia blocked the progress of the coagulating process.

successful performance of the author's procedure described.*

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*In the last series of cases the author used short wave electrocoagulation with gratifying results. It eliminates many drawbacks (no grounding of patient, precise coagulation, etc.) of the diatherm apparatus usually used.

OPERATIVE MORTALITY OF "INOPERABLE" CARCINOMA OF COLON AND RECTUM

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AMONG the "captains of the men of death" malignancy yields in rank only to heart disease. With a longer average life span carcinoma, especially in the digestive tract is of increasing importance. More than half the cases are found in the colon and rectum, thereby earning the attention not only of the specialist and practitioner but of the laity as well.

Our experience, with over 800 of these cases, has led us to certain definite conclusions.

1. To-day, surgery offers the only approach to the problem. The type of operation cannot be standardized, the individual must be studied carefully, although the procedure is relatively unimportant when compared with the skill and experience of the surgeon. We consider all forms of treatment such as radium and *x*-rays as adjuvant or purely palliative.

2. The operability of these cases is far higher than is commonly supposed by both the laity and the profession itself.

Well planned, radical surgery has restored innumerable patients to a normal and useful life; but many more have been labelled inoperable and condemned to a lingering death, alleviated only in part by palliative measures when surgery should have been given a chance. It is to the reduction of these so-called inoperable cases that all efforts are being directed. We feel that no useful purpose is served by the continual harping on the importance of early diagnosis, and that one should concentrate on disseminating the knowledge that many cases are not, in reality, hopeless.

There are three cardinal factors governing operability, (1) the skill and experience of the surgeon; (2) the condition of the patient; and (3) the site of the lesion, degree of local infiltration and extent of metastases. We have placed the ability and understanding of the surgeon first, because with an expanding experience comes a fixed unwillingness to refuse operation to any patient who by the greatest stretch of the imagination could be considered operable.

FIG. 1. Case 1. Gross specimen.

The general condition of the patient is, of course, important but with improvement in preoperative and postoperative treatment, together with a better and larger armamentarium of anesthetics, the surgeon is no longer so severely restricted. Generally speaking anyone who is not moribund can be prepared to-day to withstand almost

any operation. Age is no longer a barrier, nor cardiac and pulmonary pathology a contraindication to lifesaving surgery.

1. The importance of carcinoma of the colon and rectum.
2. The increased percentage of cases which are truly operable.
3. The necessity of procuring a really expert opinion as to treatment.
4. The amazingly successful outcome of some apparently hopeless cases.

In support of these conclusions the following "inoperable" cases are offered.

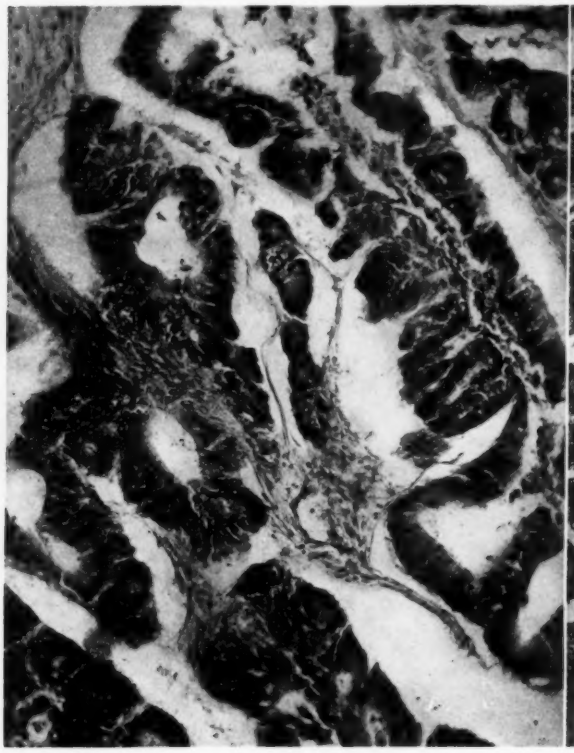

Fig. 2. Microscopic section of adenocarcinoma. High power magnification.

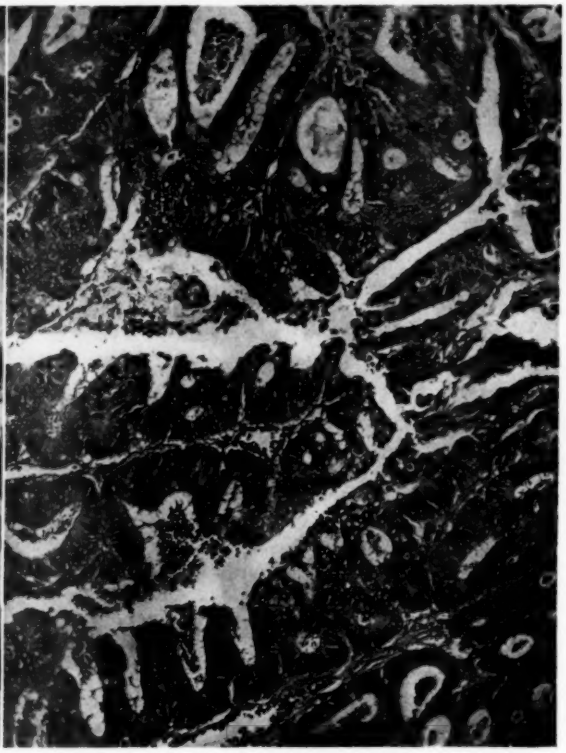

Fig. 3. Case II. High power magnification.

The site and degree of fixation of the tumor were formerly of the utmost importance because the operation might become so severe and prolonged as to cause death from shock. To-day the expert surgeon is not so troubled even with the most difficult operation.

Both local and distant metastases once were considered sufficient to brand the case inoperable. Yet, what surgeon of experience in cancer cannot point to cases who lived many years of useful postoperative life, dispite not only metastases left behind but sometimes even actual primary growth?

We fully realize that we are offering an argument rather than a proof. We do not know whether carcinoma is increasing or not, but we do know that the operability rate *is* increasing. In conclusion we have endeavored to show—

Case 1. Female, age thirty-six years, was seen in November, 1927, complaining of three years duration of progressive constipation at times amounting almost to obstruction and marked loss of weight. She had consulted doctors at frequent intervals and was once *x*-rayed with resultant diagnosis of appendicitis. A famous Midwestern clinic recognized the condition and pronounced it inoperable.

Family History. Her mother died, aged fifty years, of carcinoma of stomach (inoperable).

Physical examination, a fixed mass, 5×8 cm. was palpated in the cul-de-sac.

Operation, November, 1927, Lynch's Modified Perineo-abdomino-perineal resection of the rectosigmoid with an end-to-end anastomosis

leaving the sphincters ani intact. Her recovery was uneventful.

Three months later, plastic operation on the perineum was done. Since then patient has been well, has performed her usual duties and has put on weight. She has always had full control of her feces.

Pathological Report. Adenocarcinoma. Histologically Grade II, Dukis Grade B. Figs. 1 and 2.

February, 1936, the patient came to the office for a follow-up examination. She feels well and is putting on weight.

Case II. Female, aged forty-two years, was seen April 4, 1926, giving a history of progressively increasing diarrhea with passage of blood, worse the last six weeks and which began three years ago with "mucous colitis." Three weeks ago a series of *x*-ray pictures of the gastrointestinal tract was followed by a blood transfusion. She had lost thirty pounds in the past year.

Examination. There was a hard indurated mass at the anorectal ring.

Operation. April, 1926. An abdomino-perineal resection of the rectosigmoid was done and blood transfusions of 700 c.c. were given pre- and postoperatively. The recovery was uneventful. In 1928, a papilloma of the anterior rectal wall, 6 cm. from anal the margin was removed by snare and its base cauterized.

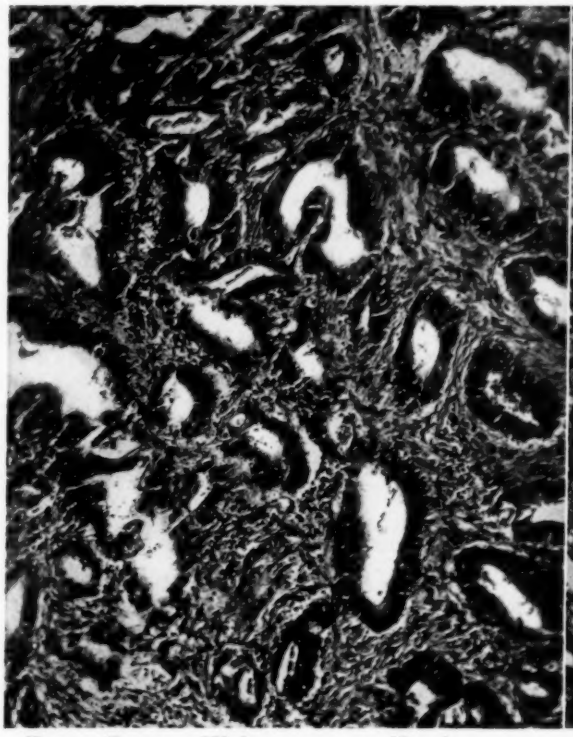

Fig. 4. Case III. High power magnification.

Fig. 5. Case V. High power magnification.

In July, 1930, rectal discomfort led to the discovery of a recurrence in the anterior wall.

Operation. A portion of the vagina and 5 cm. of the lower bowel were removed and the sacral hollow evacuated. Her recovery was uneventful but a vaginal fistula persisted for some time. The patient has led a normal useful life ever since and has put on weight.

Pathological Report. First specimen Grade II. Dukis Grade B. Second specimenPapilloma, section cannot be found. Third specimen Grade III, Dukis Grade C. January 1936, she replied to a follow-up letter stating that personal affairs kept her too busy to come to town. She feels well and is gaining weight.

Case III. Male, aged thirty-four years, was seen December 5, 1923, complaining of diarrhea and severe pain in rectum. Three and one-half years ago, he had a sharp pain in rectum passing to the back and passage of blood and mucous. Recently there are 8–10 stools daily. Three years ago he had had a hemorrhoidectomy done. One month ago a biopsy of the tumor of the rectum was reported as malignant. Nine days ago radium was used but the

resultant pain was so severe that we were consulted as to the feasibility of a palliative operation. His family history was essentially negative.

Physical examination showed a weak, wasted, icteric individual. Rectally, an enormous mass, 5 to 6 cm. in diameter was felt above the prostate and bulged into the peritoneal cavity. Operation left rectus colostomy was done, Dec. 11, 1923 followed four weeks later by a perineal excision of the rectum and evacuation of the prostatic abscess. His recovery was uneventful. The patient has full control of the colostomy and is still leading a normal life.

Pathological Report. Adenocarcinoma. In February 1936, he was seen in the office for a follow-up. He feels well and is living a normal life.

Case IV. Male, age forty-three years, was seen April 20, 1926. Seven months ago he began to have pain in the lower left quadrant on defecation with explosive movements of gas and mucous. He had been treated by doctors and osteopaths.

Examination 13 cm. from the anus, on the anterior rectal wall, a large carcinoma was seen.

Operation May 5, 1925, a perineal resection of rectosigmoid was done. His recovery was uneventful. On March 2, 1936, the patient was endeavoring to secure life insurance.

Pathology Report. Adenocarcinoma, histologically, Grade II, Dukis B.

Case V. Male, aged sixty-three years, was seen December 6, 1929. His family and past history were essentially negative. For the past three or four years he has been ill, presumably peptic ulcers. Four months ago he had a prostatectomy and two months ago a cholecystectomy was done. At this operation "inoperable" carcinoma of the cecum was diagnosed. He had no relief from either operation. After operation he had hiccoughs which lasted sixteen and eleven days respectively.

Operation Dec. 14, 1929. The right half of the colon with carcinomatous mass at distal 8 inches of the ileum was removed and a ileocolostomy was done. His recovery was uneventful. The colostomy was well controlled; the stools were *well formed.*

Pathology Report. Adenocarcinoma. Grade II, Dukis B. In February 1935, the ileocolostomy was closed at the request of his bride. His recovery was uneventful. The patient feels well, and works harder than ever. In February, 1936 was seen at the office, "Feels better than ever."

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* *Continued from p.* 434.

ORGANIZATION OF TRANSFUSION SERVICE AND BLOOD DONORS BUREAU FOR AVERAGE HOSPITAL

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THE organization of a Transfusion Service and Blood Donors Bureau, which we describe in this report, is one which has been in successful operation at the Memorial Hospital for the last six years.

Prior to the development of our present system, there were several reasons why the procedure of blood transfusion did not have the full confidence of our Attending Staff. In the first place, a suitable donor could not always be obtained in time to be of service in an emergency, and in any case, the procedure could seldom be scheduled at a definite time with the assurance that a suitable donor would be available. Furthermore, severe posttransfusion reactions occurred with sufficient frequency to cause blood transfusions to be regarded with some apprehension.

The responsibility for these posttransfusion reactions was not definitely fixed, and therefore no direct steps were taken to determine the cause. Those who had selected the donor and performed the compatibility tests were always of the opinion that the technique of the transfusion itself was at fault, while the surgeons were equally certain that an error had been made in the compatibility tests. We are of the opinion that posttransfusion reactions are in most instances due to an incompatibility of the admixed bloods, and rarely to faulty technique in the transfusion itself.

Immediately after the occurrence of a posttransfusion reaction, a determined effort should be made to track down the responsible error. The search should logically begin at the most likely source of error, that is, the compatibility tests. These tests should be repeated, and with fresh samples of blood, if these are obtainable. If the bloods are found to be compatible, then inquiry into the technique of the transfusion itself must be made. The fault, whether in the blood tests or transfusion technique, cannot be readily discovered and subsequently avoided under a system of divided responsibility, such as is found in most hospitals where the Surgical Department performs transfusions with donors selected independently for them by the Laboratory Department.

At the Memorial Hospital, under our present plan of organization for a Transfusion Service, reactions occur very rarely, and are never alarming in character or degree. Cross matched and compatible donors are delivered to the operating room at a scheduled time, and the procedure of blood transfusion has attained the dignity of any other surgical procedure, and enjoys the full confidence of our Surgical Staff. We submit this plan as a tested and practical method of insuring the safety and availability of blood transfusion within a given institution.

The personnel of the Transfusion Service in Memorial Hospital consists of a surgeon and one specially designated member of the Laboratory Staff, who is known as the Laboratory Assistant. The surgeon directs and is responsible for all phases of the Transfusion Service, such as the selection of donors, blood typing, compatibility testing, and the routine operating room technique of the transfer of the blood, although any member of the Attending Staff may perform his own transfusions, if he so desires. The surgeon in charge of the

Transfusion Service is familiar, by training and experience, with the technique of compatibility testing, and in the case of a doubtful agglutination reaction, he is consulted and assumes full responsibility for the compatibility of the donor to be used.

We have a standardized form of operating room technique, which is a modification of the Lindeman multiple syringe-canula method. This method is, we believe, the most flexible and practical method of blood transfusion yet devised. It requires a surgeon and an assistant, but this fact is an advantage, since it permits the systematic training of the House Staff.

The form of all the laboratory tests is approved by the Director of Laboratories, but the Laboratory Assistant has full charge of the Donors Bureau, the supply of stock sera, and personally performs all typing and compatibility tests, and certifies the donor as being suitable for each transfusion. One of the most important and practical benefits of such an organization is that there is no division of responsibility, so that any untoward reactions following

HOSPITAL

NAME _____ FILING No. _____

CASE No. _____

RECORD OF TRANSFUSION

COMPATABILITY TESTS:

Patient ..... Jansky, grouped by _____

Donor ..... Jansky, grouped by _____

Cross / One way } matched by .....

DONOR: Name ..... Age ..... M.S.W.D. No. of previous transfusions .....

Address ..... Tel. ..... Family ..... Friend—Professional.

Hb. ..... % ..... Date registered ..... 192 .....

TRANSFUSION: Date: ..... 192 ..... Time: ..... A.M.—P.M.

Given by Dr. ..... Ass't Dr. ..... Reason for transfusion .....

Method used ..... Time consumed in the actual transfer of blood ..... min.

	Don.	Rec.
Arm of.....		
Vein delivered.....		
Direction of needle.....		

Amount of blood given ..... cc.

Events during transfusion:

Condition immediately after transfusion:

REACTION AFTER TRANSFUSION:
If T.P.R. are abnormal during the first 48 hours following the transfusion, state that fact and give the probable explanation in the space below.

Temperature range during week preceding transfusion.

High ..... °F. Low ..... °F.

NURSE'S RECORD

Time	T	P	R	B.P.
½ hour				
1 hour				
1 ½ hour				
2 hour				
2 ½ hour				
3 hour				
3 ½ hour				
4 hour				

RECORD OF BLOOD EXAMINATIONS: (Date and indicate whether before or after transfusion.)

Date							
Hb.							
Rbc.							
Wbc.							
Polym.							
Large L							
Small L							

REMARKS:

FIG. 1. The Transfusion Sheet makes up a part of the permanent hospital record. After the recording of the compatibility tests, this form accompanies the donor to the operating room, where it serves to identify him as being compatible with a certain patient. The sheet also contains a record of the transfusion itself and of the patient's temperature the first few hours following the transfusion, as well as the record of blood examinations.

transfusion may be thoroughly investigated without delay, the error discovered and steps taken to avoid its repetition.

considered simply as short cuts preliminary to selecting a donor who will probably cross match. The results of these tests, with the

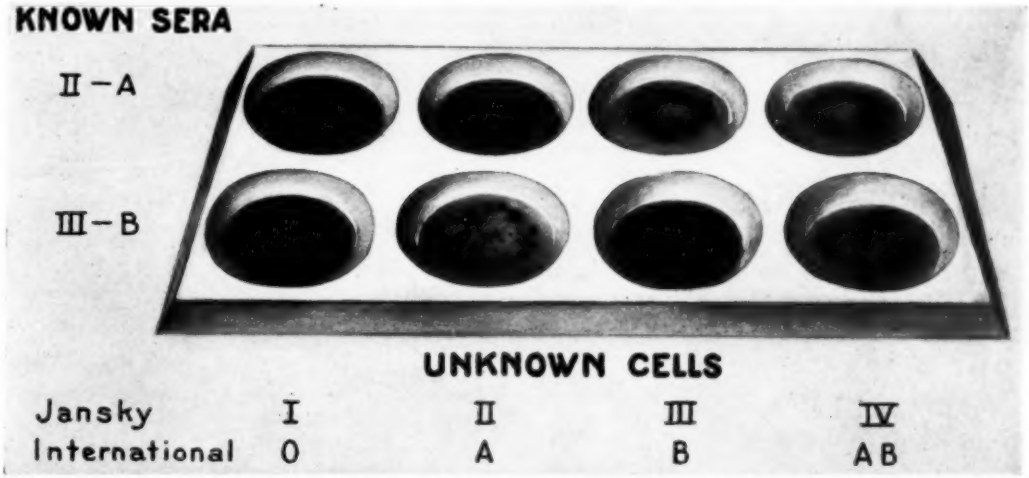

Fig. 2. The opaque white background of the china or porcelain trays used for mixing water colors is ideal for the determination of the agglutination reaction, and there is little temptation to use the microscope. These trays may be obtained in any shop dealing in artists' materials.

The details of an individual transfusion, under our organization, are usually about as follows: One of the members of the Attending Staff decides that a transfusion is required by one of his patients. He so informs the Resident Surgeon, who arranges with the patient for the donor's fee, or for the volunteer services of a relative or friend. The Resident Surgeon then sends to the Laboratory Assistant a specimen of the patient's blood, with a request for a donor at a specified time. If there are to be volunteer donors, samples of their blood are also drawn and sent to the laboratory with the proper information. The Laboratory Assistant then types the recipient's blood, and if a professional donor is to be used, one of the required group is telephoned to be on hand a sufficient interval before the time of the transfusion, so that further compatibility tests may be done.

The donor reports directly to the laboratory, where the Laboratory Assistant draws a few c.c. of his blood, separates the cells and serum, and cross matches both cells and serum with those of the recipient. This final cross match is considered the real test of compatibility, and is never omitted. The typing of the patient and donor are

name of the patient and donor, are then written down under the proper headings on the "Transfusion Sheet" (Fig. 1), which accompanies the donor to the operating room. These data are checked again by the operating room nurse before the donor and patient are brought in for the transfusion.

After the completion of the transfusion, the Resident Surgeon fills in the data of the transfusion on the sheet, which must then accompany the patient back to the ward. The ward nurse takes the temperature, pulse and respiration every one-half hour for four hours, and notes these data in the proper place on the "Transfusion Sheet." If a chill or a temperature above 101°F. occurs within the first four hours, not explained by some other factor of the patient's illness, a reaction is said to have taken place. The cause of this reaction is investigated in every instance by repeating the compatibility tests, the cells and sera of both patient and donor having been saved for this purpose. Since establishing these precautions, we have not found any incompatibility of the bloods. The knowledge that a re-check will be made in the event of even a slight reaction will insure the most careful tests beforehand.

DONORS BUREAU

Any hospital where as many as fifty transfusions are done yearly may operate its own Donors Bureau with great convenience to the Staff and benefit to the patients. The use of a professional donors bureau will serve reasonably well for an occasional transfusion, but in our experience, the donors obtained from such sources are less reliable in character, and are often found to be suffering from secondary anemia as the result of too frequent giving of blood. It has never been possible for a donor to live entirely on the proceeds from his transfusions for any great length of time, without other resources. Nevertheless, many professional donors attempt to do so by registering at several professional bureaus. We have found several donors from such bureaus reporting for a transfusion with a hemoglobin of 40 to 60 per cent. In some of these instances, the donor was more in need of a transfusion than the patient, and in any case, the blood from these anemic donors if of little therapeutic value.

We have operated our own Donors Bureau for the last six years. At first, it was necessary to advertise for donors in the Help Wanted columns about once or twice a year. We accept only robust, healthy men of young or middle age. Since there is never a lack of applicants, it is best to reject all who have given more than three or four transfusions, and to give preference to those who have not previously acted as donors. The management of this Bureau is in charge of the Laboratory Assistant, who soon comes to know individually the more dependable donors. A donor is not used oftener than at three months intervals and will average about three transfusions a year. These men will bring in their friends as applicants, so that in recent years, we have not found it necessary to advertise for donors. At the time of the donor's first application, a special form is filled out and filed for future reference. This information is checked from time to time by means of a reply postcard, one section of which is addressed to the donor requesting that he fill in and mail to the Hospital the questionnaire set forth on the other part. It is to be noted that a telephone number is one of the most important qualifications of a donor. In New York City, a professional donor must also carry a "passbook," issued by the Board of Health. We have always complied with this ruling, though it has not been of any practical value to us.

Each time a donor reports for a transfusion, a hemoglobin test is made, and the serum saved for a Wassermann. After about six or eight transfusions, a donor should have a red blood cell count, as well as a hemoglobin test.

We know of no certain means of avoiding the theoretical transmission of syphilis by transfusion. A Wassermann test cannot be done immediately preceding each transfusion, and even if it could be done, it is still theoretically possible to transmit the infection. In practice, however, we know of no instance where such an accident occurred.

By subtracting a small percentage (5–10 per cent) of the donor's fee in suitable cases, we have established a transfusion fund. From this fund, we are able to pay all or part of the cost of a donor in a total of five to ten transfusions per year for indigent patients.

COMPATIBILITY TESTS

For practical purposes, we continue to use the Jansky system of blood grouping. The International System is probably more scientific, but it is apt to cause confusion in practice, especially from the clerical standpoint. There are often one or more persons involved in the giving of every transfusion to whom the presence or absence of specific agglutinins in the several blood groups, upon which the International System is based, will always remain a complete mystery. However, the Jansky System, using simply four numbers applied to the four groups, in the order of their frequency

of incidence, can hardly be a source of error.

We always insist that the donor and recipient be of the same type. The use of the so-called universal donor is not always safe, especially if large transfusions are given.

We believe that a direct cross match of the cells and sera of the patient and donor is the minimum precaution to be taken before any two bloods may be said to be compatible. Typing of the donor and recipient is simply a preliminary short cut, in order that a donor may be selected who will probably cross match perfectly. If two bloods are of the same type, they will almost invariably cross match, but, in our experience, *all errors in compatibility testing have occurred with bloods which were typed, but not cross matched.* In cross matching, the first donor may be rejected, and another selected, if there is any suspicion that agglutination occurs, whereas, in typing, the presence or absence of agglutination is of equal significance, and error cannot be avoided by discarding the questionable blood, especially if it belongs to the patient.

Stock sera of types II and III Jansky, or Moss, are kept on hand at all times for typing. These should always be dated and kept in the icebox, except when in use, and should be frequently renewed by saving the sera from types II and III blood, as they are tested. In institutions where few transfusions are done, the supply of stock sera is kept up with some difficulty, but may be renewed by calling in a donor. If necessary, perfectly satisfactory typing can be done, using both cells and serum of either II or III blood alone. It is best to keep several specimens of each on hand at all times. After two weeks, a serum tends to lose its potency. Freshly drawn serum is always most active and dependable.

Agglutination, the phenomenon by which blood groups are determined, is a macroscopic phenomenon. It is best observed on a white opaque background, and for this purpose we have found nothing more satisfactory than the china or porcelain trays which are used for mixing water colors (Fig. 2). These trays can be purchased in any shops dealing in artists' materials.

About one drop of freshly washed cells is mixed with ten drops of undiluted clear fresh serum. The mixture should be stirred frequently to facilitate agglutination, and to eliminate occasionally confusing phenomena, such as sedimentation and "graining." A final reading should be made after fifteen minutes. The reactions which determine the classification into the several groups are too well known to require discussion here. They are shown diagrammatically in Figure 2.

We are of the opinion that a microscope should never be used to determine agglutination. If agglutination cannot be observed by the naked eye, it is not there. If one becomes accustomed to the use of the porcelain or china trays used by water color painters, there will be little temptation to use the microscope. In 1922, Ottenburg stated, "The microscope is, in my opinion, a source of error. In every instance in which the doubt has been raised by microscopic examination and settled by the examination of the person's serum, as well as cells, the naked eye observation has proven correct, the microscope confusing." (*Jour. Am. Med. Ass.*, 79: 2137–2139, 1922.) With this opinion, we are in entire accord.

POSTTRANSFUSION REACTIONS

If within the first four hours after transfusion, a chill occurs with a temperature of 103° to 104°F., there can be little doubt that the donor's blood not only was grossly incompatible, but also belonged to a different group from that of the recipient. In such cases, a re-check of the bloods with cross matching will reveal the error.

In other cases, the temperature may rise one to two degrees or more, without any other serious symptom. If the recipient has been running an irregular temperature above the normal level during the preceding two or three days, a transfusion is usually followed within an hour or two by an elevation of temperature equal to the

highest level of the preceding period. Such a reaction is not specific, and is a well known phenomenon following any surgical procedure under similar conditions. A moderate rise in temperature is almost the rule following transfusions in Hodgkin's disease, and urticaria is also frequently observed. Urticaria, coming on as a post-transfusion effect, is probably a form of anaphylaxis. If the temperature rise is greater than any other experienced by the patient within the preceding forty-eight hours, the compatibility tests, especially the cross matching, should be repeated. When these have been carefully done, before-hand, it is an exceptional occurrence to find the second cross match different from the first. Nevertheless, we feel that these tests should always be repeated in such cases, simply as a matter of discipline. If a re-check of the tests reveals no error, the technique of the transfusion should be investigated. Causes of reactions attributable to the technique may be several, as for instance, the injection of too much saline, which is often impure, during the transfusion, the injection of too much air, the use of sodium citrate as an anticoagulant, etc.

CONCLUSIONS

In our experience, the successful and safe operation of transfusion depends to a large extent on the following factors:

1. An undivided responsibility for the entire procedure, from the selection of the donor, the laboratory tests and the giving of the transfusion, to the re-check of any posttransfusion reactions.

2. The training of one Laboratory Technician to be directly responsible for all compatibility tests, the maintenance of stock sera, the selection, typing and cross matching of donors.

3. All those concerned with any of the phases of blood transfusion must freely admit that severe posttransfusion reactions do not occur without errors which are avoidable.

4. The cause of every posttransfusion reaction must be determined by a careful repetition of compatibility tests, and an inquiry into the technique of the transfusion itself.

5. It is highly desirable that each Hospital organize and maintain its own blood donors bureau.

GLOVE FLAP METHOD OF DORSAL HAND REPAIR

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THE component structures of the hand are so arranged anatomically that they may act as units or collectively but these actions are dependent upon each other, therefore if there is a derangement of one unit it will materially affect the fine balance of the whole hand mechanism; units must act in complex unison to complete full functional actions. The loss of derma and subcutaneous tissue, although only a part of hand problems, may vitally affect hand function unless a satisfactory reconstruction towards the normal is evolved.

FIG. 1. Following a burn from gasoline, the dorsum of this patient's hand and fingers as far as the distal phalangeal joints was covered with a thick, heavy, red, painful, non-elastic keloid scar that prevented finger, thumb and wrist flexion.

FIG. 2. The hand in a comfortable position in situ on the abdomen showing the finger, radial and ulnar pedicles nourishing the large central flap.

An analysis of the coverings of the dorsum of the hand reveals that compliance must be made with certain specific anatomical arrangements when complete dorsal coverage is contemplated. The derma is durable, fairly thick, and so arranged in excess without being unsightly, that free action is obtainable in the finger webs, joints, and the complete hand and finger motions are unhampered. The subcutaneous tissue is thin but of sufficient quantity and quality over bones, tendons, and joints to provide free movement of the derma as well as acting as a buffer for the skin and the underlying delicate structures.

The usual causes for the loss of the dorsal covering structures are burns, infections, trauma or complete avulsion. Hands so injured present rather typical pictures when examined for repair. If the denuded area is permitted to epithelialize by its own efforts the scar is thin, tense, contracted and by its presence holds the wrist in extension, the metacarpophalangeal joints in hyperextension, the phalangeal joints in extension or partial flexion, and there is a loss of the normal convexity of the hand by the reduction of its transverse dorsal diameter. Occasionally the scar is a thick, red keloid holding all the joints in complete extension, acting as a check rein by its unyielding structure when finger flexion is attempted. If skin grafts have been applied to the denuded area its functional condition as well as its more normal relationship to the numerous joints is in direct proportion

to the time, amount and type of skin grafted, as well as to the eventual total scar formation and contraction. Even with

Fig. 3. The entire dorsum of the hand and fingers as far as the distal interphalangeal joints covered with a single piece glove skin flap. The slight edema of the digital flaps has subsided. Notice there is no webbing of the interdigital spaces.

early skin grafting the resulting covering is often thin, atrophic, non-durable, markedly reduced in total area and interfering with joint and tendon action thus incapacitating the hand as a normal grasping unit.

To obtain the most satisfactory functional and cosmetic restoration for the dorsum of the hand, a thin one piece unit of skin and subcutaneous tissue of the proper area for the hand, webs, and dorsum of the fingers is essential. The glove flap method fulfills these requirements with certainty and dispatch.

A description of the operations on the hand in the accompanying photographs depicts a typical glove flap replacement and is sufficient to give the basic principles involved in this method of repair.

Under a blood pressure tourniquet all of the scar on the dorsum of the hand and fingers was excised; the tendon and joint areas were freed of scar to permit their maximum activity. Following the tourniquet removal complete and accurate hemostasis was accomplished. This is important as postoperative hematomata are unusually destructive to any type of skin graft. An ordinary rubber surgical glove larger than the injured member was slipped onto the

Fig. 4. Complete flexion of the fingers with a soft durable protective covering for the dorsum of the hand and fingers. Knuckles are easily discernible as well as normal dorsal arch and hand profile.

hand and sutured along the denuded edges. That portion of the rubber glove covering the defect was removed and a pattern of the denuded area obtained, sufficient material being allowed for the webs and the full range of finger motions. This pattern was placed on the right side of the abdomen and the donor skin flap and nourishing pedicles were outlined. Seven pedicles were constructed to serve and drain the center flap, one on the radial side, one on the ulnar side, and one for each of the digits. The entire flap with its attached pedicles was then elevated by sharp dissection, care being taken to make the flap as thin as possible without jeopardizing the circulation. The abdominal bed was covered with three large split skin grafts sutured into position. The injured hand was placed in the abdominal pocket and the flap pattern was sutured to the hand. The principle of parallel incisions was employed in the interdigital spaces to prevent the formation of troublesome webs. Seven days after the glove flap was created the digital pedicles were cut off under local anesthesia and sutured to the appropriate finger ends. Five days later under local anesthesia the ulnar pedicle was excised from the abdomen and sutured into position on the hand, and one week later the radial flap was similarly treated. The immobile hand with its appropriate pressure acted as a splint for

the abdominal skin grafts so that when the hand was removed from its abdominal bed a complete covering of the donor area was effected. The entire dorsum of the hand and fingers was completely covered in nineteen days by the skin glove and the patient had a total hospitalization of twenty-two days. Supervised elastic traction was applied to the fingers one week after the last operation and within a period of another ten days a complete range of hand and finger motions was obtained. At the present writing sensory nerve regeneration has taken place throughout the entire flap as evidenced by the return of sensation to pain and temperatures.

The glove flap method is highly satisfactory for quick and efficient dorsal hand coverage and the donor material so simulates the normal covering that unless irreparable deeper damage is done at the time of the original injury a maximum return of function and appearance can be expected.

SUMMARY

The fine balance of the hand mechanisms is so dependent upon the perfect functional inter-relationship of all its component parts that the damage to any one structure has an appreciable effect on the total hand action. A normal skin and subcutaneous covering is thus essential to good functional reconstruction.

A description of the operations carried out on the hand shown in the accompanying pictures depicts a typical glove flap replacement. The entire scar on the dorsum of the hand and fingers was excised. A surgical glove was placed on the hand and sutured along the denuded edges. The portion of the glove covering the defect was cut out, a pattern of the hand defect was made on the right side of the abdomen and the donor flap and seven pedicles, one for each finger; one for the ulnar and the radial side, was elevated by sharp dissection. The center flap and pedicles were made as thin as possible. The abdominal bed was skin grafted and then the injured hand was placed in the abdominal pocket and the flap pattern sutured to the hand. The digital pedicles were amputated in seven days, the ulnar pedicle in five days more, and the radial pedicle in one week more. The flaps were cut off under local anesthesia and sutured into their respective places and at the time of freeing from the abdominal wall complete take of the abdominal skin grafts was observed. The entire dorsum of hand and fingers was covered in nineteen days with a hospital stay of twenty-two days. By using elastic traction seven days after the last operation, a complete range of active finger motion was quickly obtained. At the present writing sensory nerve return has taken place.

The glove flap method is highly satisfactory for quick and effective dorsal hand coverage and the donor material so simulates the normal covering that unless irreparable deeper damage is done at the time of the original injury a maximum return of function and appearance can be expected.

Fig. 5. The abdominal donor area completely covered with pliable durable split skin grafts. The visible scars will gradually smooth and fade so that the eventual cosmetic deformity is negligible.

SKULL FRACTURES*

STUDY OF 100 CONSECUTIVE CASES

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THE importance of the problem of the fractured skull increases with the rising mortality from vehicular accidents. The wide distribution of motor traffic has, of necessity, placed the responsibility for the management of these accident cases in the hands of the general surgeons of the country. The rural districts and the smaller hospitals are receiving 64 per cent of these patients.

In reviewing the recent literature on the subject of the management of cranial injuries, a surgeon is impressed by the radical and fundamental differences of opinion expressed by authors of equal authority and experience.

From Baltimore comes a warning against lumbar puncture and dehydration and an endorsement of subtemporal decompression to relieve increasing intracranial pressure; from Philadelphia comes the strongest recommendation for dehydration; from New York, as a result of thirty years experience at the Harlem Hospital in the treatment of 1760 cases, comes a recommendation for routine lumbar puncture and a strong condemnation of the dehydration treatment so enthusiastically recommended in Philadelphia; from Boston comes advice to begin dehydration early, reserving spinal puncture and operation as successive steps to be used in combatting an increasing intracranial pressure; and from Chicago, after a careful resume of 2445 cases, comes advice similar to that emanating from Boston, with perhaps less enthusiasm for spinal puncture and a strong warning against early operation, especially in the presence of shock. In view of this confusion of expert advice, general surgeons should be interested to check their own results and attempt to lower the average mortality of 25 per cent.

With this objective the following study has been made. Table 1 indicates the increasing number of accidental deaths and emphasizes the importance of this problem.

TABLE 1

INCREASE OF FATAL ACCIDENTS

Accidental deaths 1913.....	82,460
Accidental deaths 1932.....	89,167
Accidental deaths 1933.....	91,087
Accidental deaths 1934.....	101,000

Motor vehicular deaths in 1934—36,000, 15 per cent increase over 1933; 64 per cent of motor vehicular deaths occur in the rural area. Persons injured by motor vehicles in 1934, 1,250,000, or 1 of every 100 population. It is estimated that in the United States 112,000 skulls are fractured annually with 28,000 deaths, a mortality of 25 per cent.

TABLE II

FRACTURE OF SKULL

ANALYSIS OF 100 CONSECUTIVE CASES

Sex Distribution		Age Distribution		
Male.....	79	2– 5 years	11 cases	41 cases with 5 deaths or a mortality of 12.1 per cent
Female....	21	5–10 years	14 cases	
	—	10–15 years	5 cases	
	100	15–20 years	11 cases	
		20–30 years	20 cases	59 cases with 18 deaths or a mortality of 30.5 per cent
		30–40 years	16 cases	
		40–50 years	10 cases	
		50–60 years	7 cases	
		60–70 years	3 cases	
		70–80 years	3 cases	

Table II emphasizes the fact that the mortality in the group of 41 cases under twenty years of age is about one-third that of the older group. It also calls attention to the importance of knowing the age

* Read before the Surgical Section of the New York Academy of Medicine, October 17, 1935.

distribution of the cases in estimating the mortality figures of any given series.

TABLE III
CAUSE OF ACCIDENTS

Agent	Number of Cases
Auto	62
Fall	19
Coasting	6
Struck by train	2
baseball	2
beam	2
golfball	1
baseball bat	1
glass bottle	1
sign	1
cement block	1
flatiron	1
iron pipe	1
	100

It is interesting to note that 62 per cent of these cases were caused by motor vehicular accidents and to remember that 64 per cent of motor vehicular accidents resulting in deaths occur in rural areas.

TABLE IV
X-RAY FINDINGS

X-ray film taken		46 cases
Positive for fracture	37 cases	
Unsatisfactory	3 cases	
Questionable	3 cases	
Negative for fracture	3 cases	
X-ray film not taken		54 cases
Condition too serious	11 cases	
Fracture visualized at operation	43 cases	

The *x*-ray picture is of great importance in making a diagnosis in doubtful cases. No head injury should be discharged until a fracture has been eliminated by *x*-ray examination.

It is not necessary for many obvious cases and should never be permitted while a patient is in shock. Only 46 per cent of these cases were *x*-rayed.

PATHOLOGY

The most difficult and important part of this problem is to estimate the extent of pathology within the damaged cranium for rational treatment can be based only upon this information. Therefore each case must be studied individually for many times it is impossible to know what has taken place within the skull of an unconscious patient.

We have listed in Table v some of the pathological conditions found in this series of cases.

The fracture line is of importance only insofar as it may be related to the damage of the underlying brain or as a possible source of infection.

TABLE V

Site of Fracture	Number Cases	Recovered	Died	Mortality Per Cent
Vault	66	56	10	15.1
Base	29	18	11	37.9
Base and vault	5	3	2	40.0

Complications	No. Cases
Compound fracture	2
Compound depressed fracture	24
Epidural hemorrhage	3
Subdural hemorrhage	10
Longitudinal sinus injury	2
Cranial nerve injuries	11
Fracture through frontal sinus	–
Fracture through cribriform plate	1
Fracture through middle ear	21

TABLE VI
ADDITIONAL MAJOR INJURIES

No. Cases	Site of Fracture
	Recovered
1	femur and humerus
1	tibia and fibula
1	humerus
1	ribs
1	ankle
2	malar bone
1	bilateral, femur and patella
1	compound, elbow, tibia and fibula
	Died
1	humerus
1	femur
1	malar bone and clavicle
1	nose and maxilla
1	ribs and internal injuries
1	compound, hip and both bones leg
1	bilateral, base and bilateral lower jaw

These additional major injuries add to the surgical shock and operative risk and mortality.

So far as was possible these patients have been treated on the basis of the estimated pathology and degree of intracranial pressure.

MANAGEMENT

From the point of view of management and in accordance with Mock's classification, these cases have been divided into four groups.

TABLE VII
CLASSIFICATION AS TO TREATMENT

	No. Cases	Recoveries	Deaths
Group 1. These patients had only rest in bed.	9	9	—
Group 2. These patients had special treatment for shock and concussion, other than lumbar puncture or operation. Five of the deaths occurred during the period of initial shock and before lumbar puncture or operation could be done.	51	44	7
Group 3. These patients had special treatment and lumbar puncture for symptoms of intracranial pressure. Two of the deaths were due to late meningitis, and two occurred shortly after lumbar puncture.	10	5	5
Group 4. Operated cases.	30	19	11
	Total	Recovered	Died
Compound fracture.....	23	16	7
Subtemporal decompression for epidural and subdural hemorrhage.....	7	3	4
	30	19	11

Group 1 includes the patients who, on admission, required no treatment other than rest in bed. There was no shock or disturbance of consciousness. There was a history of a head injury and *x*-ray evidence of a linear fracture. There were 9 of these patients and all recovered.

Group 2 includes all the patients outside Group 1 who had no spinal puncture and no operation. In this group are the patients who received treatment for shock and those who received dehydration treatment. In this group are included 5 cases so severely injured that death occurred during the initial shock. One case died suddenly on the third day and another died of pneumococcus meningitis following a frontal sinus fracture.

In Group 3 are included those patients who, in spite of dehydration and other treatment developed symptoms of increasing intracranial pressure and received one or more lumbar punctures but were not operated.

These were all serious cases. Lumbar puncture was not done as a routine but on definite indications of a rising intracranial pressure and breaking compensation.

There were 10 cases in this group with 5 recoveries. A brief description of the 5 fatal cases may be of interest.

CASE I. A man seventy-four years of age in very poor general condition with a fracture through the cribriform plate, developed a pneumococcus meningitis on the third day and died on the fifth.

CASE II. A young woman eighteen years of age, apparently recovering from a fracture through the frontal sinus, developed pneumococcus meningitis and died on the tenth day.

CASE III. A man thirty-five years of age had a spinal puncture five hours after admission for increasing intracranial pressure. He died five hours later without regaining consciousness. Autopsy showed a fracture through the right temporal bone with a large epidural hemorrhage in the right temporal fossa and a larger subdural hemorrhage on the left side with a laceration of the left temporal lobe.

CASE IV. A man fifty-five years of age with symptoms of increasing shock and coma. Lumbar puncture done twenty-two hours after admission delivered only a small amount of bloody fluid under no tension. He died seven hours later.

CASE V. A young man twenty years of age in profound shock from which he never recovered. One spinal puncture done withdrawing 10 c.c. He was given hypertonic glucose with no improvement and died within a few hours. This is the only case in the group about which a question might be raised as to the advisability of subtemporal decompression.

Group 4 represents the operated cases and comprises 30 per cent of the series. Twenty-three of these were compound fractures with more or less depression and comminution. There was no choice as to procedure in this group. Of the 7 subtemporal decompressions, 3 recovered. The 4 deaths were associated with ex-

tensive subdural hemorrhage and brain laceration.

A special technique to avoid additional trauma to the dura and brain tissue should be acquired by the surgeon who operates these cases. Special instruments, including a Hudson drill, saline irrigation and suction, bone wax, specially fine needles and silk should be provided by all hospitals accepting these patients for operation.

Table VIII

ANALYSIS OF DEATHS

8 cases died in initial shock, five minutes to a few hours after admission.

1 case died on the third day, questionable conservative treatment.

3 cases died of pneumococcus meningitis:
- 2 frontal sinus cases,
- 1 cribriform plate fracture.

11 cases died following operation:
- 7 severe compound fractures associated with intracranial hemorrhage and brain laceration,
- 4 subtemporal decompression for epidural and subdural hemorrhage.

6 of the deaths following operation occurred within the first forty-eight hours.

All of the 11 postoperative deaths seemed to be due to shock and brain injury.

Table IX

COMPARATIVE STATISTICS

Author's Series 100 Cases	Per Cent	Mock's Series 100 Cases Per Cent	Munro's Suggested Maximum Permissive Mortality—Per Cent
Non-operated cases.....	70.0	87.0	10–12
Mortality	17.3	17.2	
Operated cases...	30.0	13.0	
Mortality	36.0	37.6	25
General mortality	23.0	20.0	15–17

Munro's suggested maximum permissive mortality is an arbitrary standard which he thinks might be reached by more particular study and attention to the management and care of these seriously injured patients. It is a reasonable goal.

If the surgeons and hospitals throughout the country could be aroused to study and report their individual mortality figures a general improvement in the care of these patients would follow with a reasonable hope of reaching the standards set by Munro.

SUMMARY

As 64 per cent of motor vehicle accidents occur in the rural districts and 60 per cent of skull fractures are due to these accidents, the treatment of a large number of skull fractures becomes the problem of the suburban hospital and the general surgeon. The present mortality of approximately 25 per cent should be reduced by the conservative management of these cases.

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DESCRIPTIVE TERMS FOR ABDOMINAL ELECTROSURGERY*

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FROM time to time articles dealing with methods for abdominal electrosurgery have appeared, but as the subject is comparatively new the descriptive titles have been more or less clumsy, for instance, "electrosurgical gastro-enterostomy,"[1,2,3] "electrosurgical anastomosis,"[4,5,6] "electrosurgical cholecystectomy,"[7,8,9] "electrosurgical appendectomy,"[10] "electrosurgical enterostomy."[11] It is suggested that the word "surgical" be omitted and replaced by a hyphen, with the result as "electro-appendectomy." I am taking the liberty to apply these terms only to methods devised at the Massachusetts Memorial Hospitals, brief descriptions of which are given.

Electro-appendectomy. The base of the appendix is lightly crushed, tied with linen, amputated with the "cutting current," heavy dehydration, slowly with the flat of the blade to produce a cautery effect. Then the whole stump, including a section about 2 mm. below the linen tie, is thoroughly treated with the biterminal coagulating current by fulguration, or sparking, and light contact coagulation. The stump is then inverted with a double row of gastroenteric sutures. The advantage of the method is that after twenty-four to forty-eight hours the stump sloughs into the lumen of the cecum, leaving clean, infolded, closely approximately edges. Thus the chance of abscess in the cecal wall is avoided.

Electro-gastroenterostomy. At the sites for anastomosis on the stomach and intestine the seromuscular coats are incised with the ordinary scalpel, exposing the submucosa. This is thoroughly treated by fulguration and light contact coagulation. The charred areas are carefully approximated with a double row of gastroenteric sutures. Recently it has been found preferable to leave a free, untreated rim of mucosa about 1 cm. wide on the stomach side. This flap of mucosa tends to cover the granulating edges of the wound and reduce the amount of constriction at the stoma from sclerosis.

Electro-anastomosis of the Intestine. For lateral anastomosis the method is essentially the same as for gastroenterostomy.[2] For end-to-end anastomosis[4,5] the section of gut to be removed is doubly tied at either end, cut across between the ties with the "cutting current," heavy dehydration, slowly, for cautery effect. About 2 cm. from the ties on the ends to be joined, the gut is crushed with a clamp at right angles, to make a line of demarkation for the placing of sutures. Then the whole of either end of the intestine to be anastomosed is treated by fulguration and light contact coagulation, including the portion crushed with the clamp, which crushing incidentally helps to devitalize the gut. The coagulated "buttons" on either end of the gut are invaginated with a double row of joining gastroenteric sutures. After twelve to twenty-four hours the "buttons" of coagulated tissue slough, leaving the edges of gut well approximated. They heal with very little constriction of the lumen. This method is aseptic and safer than those used ordinarily.

Either before or at the time of the anastomosis it is generally advisable to perform an enterostomy. This may be done aseptically as follows:

Electro-enterostomy. A rubber tube with beveled end is sewed onto the bowel, the end being buried with inverting stitches. A rod slightly longer than the tube, carrying a loop electrode, is placed within it. Using

* From the Evans Memorial for Clinical Research and Preventive Medicine and the Surgical Clinic of the Massachusetts Memorial Hospitals, Boston.

the "cutting current," heavy dehydration, the wall of the bowel at the end of the tube is incised. The rod is withdrawn slightly to act as an obturator and the tube is then pushed through the opening as the sutures are tightened. The tube is stitched in place and the intestine at that point fixed to the abdominal wall.

Electro-cholecystectomy. With the "electric scalpel," heavy dehydration, (Bovie Unit), the gall bladder is split to the cystic duct, which is tied, if this can be done safely. Otherwise a tube drain is attached. With the same current the leaves of the gall bladder are cut away to about 1 cm. from the attachment to the liver, the branches of the cystic artery being clamped and tied as they are encountered. Then the mucosa on the section of gall bladder which remains attached to the liver is treated by electro-coagulation (Bovie unit) with high voltage, biterminal fulguration and light contact coagulation. This chars the surface slightly and coagulates to a depth of 2 to 3 mm., sufficient for destruction of the mucosa. The whole surface must be thoroughly treated because even a small section not devitalized may regenerate, leading to a persistent sinus. If the gall bladder is much thickened some of the tissue attached to the liver may be "scalloped" away with the loop-electrode, using "cutting current," heavy dehydration, after which the base is fulgurated as previously. This method seems preferable to deeper coagulation, leaving a considerable amount of dead tissue. Drainage is employed.

The advantage of electro-cholecystectomy lies in a better control of hemorrhage with the acutely inflamed or sclerotic gall bladder where there is considerable danger in ordinary cholecystectomy. It is not recommended, however, in the thin walled gall bladder which can be dissected readily.

Electro-cholecystocausis or Cauterization.[12] This procedure is applicable in those cases where the risk is so great that only a cholecystostomy is advisable. The object of "cholecystocausis" is to bring about obliteration of the gall bladder by an operation which involves little more shock than mere drainage. It is most easily adapted to the enlarged, palpable, thick walled gall bladder. Through a small incision the fundus is exposed, aspirated and opened widely. If it can be done without tension, the edges of the opening in the gall bladder may be stitched to the abdominal wall, otherwise the opening is maintained by guy sutures or clamps. Then with the aid of a focusing headlight and special insulated retractors, the whole mucosa of the gall bladder is thoroughly treated with biterminal fulguration, or sparking, and light contact coagulation. Deep coagulation, resulting from pressure of the electrode against the surface, must be avoided to prevent perforation of the gall bladder and damage to the adjacent structures. Several Penrose drains are placed in the cavity and the wound closed loosely about them.

With the poor risk patient who has a thin walled gall bladder, but with whom a cholecystostomy is indicated on account of biliary colic from stones, "cholecystocausis" may still be done. Extra care is required, however, in the treatment of the mucosa. The current must be light enough to avoid coagulation of the whole thickness of the wall, and only fulguration, with not too heavy a spark, and extremely light contact coagulation, is permissible. The treatment of the mucosa should be begun at the top and the serosa occasionally inspected with the object of avoiding color changes from deep coagulation.

If the treatment has been too light to destroy all the mucosa and a sinus persists after drainage, the process can be repeated with very little disturbance to the patient. It will now be safer on account of the inflammatory thickening of the gall bladder. This repetition of the treatment is preferable to causing perforation of the gall bladder at the first operation. For the beginner with the method it would be advisable to drain first, placing several rubber dam gauze wicks in the cavity. Several weeks later, after the gall bladder

had become somewhat thickened and walled off by adhesions, the sinus could be expanded and "cholecystocausis" performed. This procedure would also offer an advantage in those cases with persistent sinus after ordinary cholecystostomy, a means whereby the gall bladder could be obliterated without the danger of a difficult cholecystectomy. It would seem feasible to use the cystoscopic instruments and methods of the urologist for fulguration of mucosa in the depths of a sinus following cholecystostomy.

In certain cases of pronounced acute inflammation or gangrene of the gall bladder where the mucosa is already partially devitalized, "*chemo-cholecystocausis*," with carbolic acid for the cauterizing agent, can be employed. If there is vital mucosa, however, "electro-cholecystocausis" is more effective.*

SUMMARY

Simplified terms for electrosurgical procedures in the abdomen are suggested. The word "surgical" is omitted from titles used by the author or his associates. Brief descriptions of the methods are given.

Electrosurgical appendectomy[10] or electro-appendectomy.

Electrosurgical cholecystectomy[7,8,9] or electro-cholecystectomy.

Electrosurgical gastroenterostomy[2] or electro-gastroenterostomy.

Electrosurgical anastomosis[4,5] or electro-anastomosis.

Electrosurgical enterostomy[11] or electro-enterostomy.

A recent term is given, electro-cholecystocausis[12] (cauterization).*

* In a personal communication my former "Chief," Dr. J. E. Briggs recalls a case of gangrenous gall bladder in which he inserted a finger under the blackened mucosa and enucleated it from below upward; after which the sinus closed permanently.

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* For this term the writer is indebted to Paul J. McManus, S.J.

EFFECT OF HEAD INJURY ON HEARING AND ORIENTATION*

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INJURIES to the head that produce disturbances of hearing and orientation may be separated into three sections: (1) those which are directed to the ear or its environs, (2) those in which the force is applied to the skull not including the area of the ear and in which, from external appearances, the ear is not involved, and (3) those in which one or both ears are injured due to the force and direction of violence applied to the contour of the skull.

1. Direct injuries to the ear.

Force applied to the outside of the ear producing compression of the air in the external auditory meatus may produce rupture of the drum. When the force is great hemorrhage into the cochlea or semicircular canals or both may occur. Such injuries may be produced by a blow or from explosives. Usually the ear nearest the explosion is affected but it may affect both ears. Complete bilateral deafness from intense explosions occurring in negative pressure chambers has been observed. Such injurious agents as bullets and other sharp instruments with or without high velocity may penetrate the auditory canal or traverse the mastoid and injure the hearing and orientation either partially or completely.

2. Injuries to the skull but not directly into the ear accompanied by concussion of the brain, not necessarily associated with unconsciousness, may affect the hearing and orientation through injury to the pathways coming from the ears and traversing the midbrain and leading to the cerebellum and cerebrum. It has been stated that 90 per cent of cases of concussion complain of vertigo or giddiness and demonstrable abnormalities in response to labyrinthine stimulation can be elicited in most of them. In many instances the hearing is also impaired.

3. Direct involvement of the auditory and static-kinetic labyrinths besides injury to the nerve pathways and brain tissue particularly at the base occurs from crushing blows to the head with or without fracture of the vault or the base. A blow of sufficient force near the ear may damage the hearing organ and injure the brain through commotio cerebri. From such a blow a fracture through the petrous portion of the temporal bone and widespread injury to the intracranial contents is likely.

In this article only those injuries that produce disturbances of hearing and orientation resulting from indirect or combined direct and indirect force are considered.

The symptoms referable to such lesions are partial or complete loss of hearing, either unilateral or bilateral, tinnitus, nausea, vomiting, vertigo or variations of the same, falling and paralysis of cranial nerves.

The objective phenomena are unconsciousness, spontaneous nystagmus and past-pointing, impaired pelvic girdle reactions, instability, dysmetria, adiadochocinesis and the finding of blood in the cerebrospinal fluid. The hearing by audiometry is found to be reduced throughout the tone scale or more commonly the perception for high tones is less acute than those in the center or at the lower end. In some instances the hearing has been destroyed, particularly in cases wherein

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the petrous portion of the temporal bone is the site of a fracture or where there has been a rupture of the auditory nerve. The nystagmus induced by rotation or caloric stimulation is not usually much affected although it is likely to last less than the normal time, particularly on the side at which the force was applied. In some instances the nystagmus is perverted. The responses to stimulation of the vertical semicircular canals are not very strong and in some instances neither past-pointing nor nystagmus can be produced. Past-pointing after rotation or douching is very likely to be abnormal and this finding is persistent unless the disturbance is due to injury to the end organ alone when it disappears with the adjustments and compensations which the body makes after such injuries.

When the acute symptoms subside there is a persistence of certain phenomena that gradually improve and others remain the same or they increase in intensity.

Ordinarily, the residual findings are hearing loss, spontaneous nystagmus and past-pointing, incoordination, vertigo and impaired reactions to passive or active changes in position such as falling and impaired pelvic girdle reactions.

Hearing. In many instances the hearing is impaired both by injury to the end organ through intralabyrinthine hemorrhage and injury to the auditory pathways. Recovery of all the hearing is likely when the injury to the cochlea is slight and the hemorrhage is meager. When the hemorrhage into the labyrinth is large the clot may become organized and the resultant scar tissue perpetuates or even augments the initial hearing loss. When there is little or no injury to the end organ, but there is loss of hearing acuity the fault is to be attributed to injury to the auditory pathways. In this instance the hearing may improve for a short time after the initial insult and then gradually become worse and finally remain stationary. At the time of the injury hemorrhagic extravasations and even lacerations have occurred along the auditory and vestibular pathways in the brain stem and cerebellum. Healing takes place and the bloody extravasations are absorbed, but in the areas of injury scar tissue is formed and the attendant contractions cause a latent progression of the symptoms. When the hearing is profoundly affected and vestibular responses are produced by turning or douching, the fault is not with the end organ, for if the injury is severe enough to produce marked deafness, the static-kinetic labyrinth would be equally or more extensively involved. The hearing loss is more likely to be unilateral when the end organ alone is affected and bilateral if the cause of the deafness arises from damage to the important structures below the tentorium.

Nystagmus. The nystagmus that originates from injury to the static-kinetic labyrinth rapidly disappears. It is rare to find spontaneous nystagmus of labyrinthine origin that persists more than forty-eight hours after head injury. Rhythmic movement of the eyes encountered a considerable time after the injury is due to injury to the cerebellum. This finding is not rare and its importance when present is of diagnostic and prognostic significance.

Nystagmus of cerebellar origin shows a slow deviation and a quick return in the horizontal plane. A lesion in the lateral lobe produces a deviation of the eyes to the side opposite the lesion and then a quick return. It is observed when the cerebellar nuclei are injured, probably due to loss of cerebellar influence on the vestibular nuclei of the same side. It should not be considered cerebellar unless there is superadded to this an ataxic movement of the eyes on looking to the right or left and increased by fixation.[1] The eye movements are pendular and increased by fixation to the right or left always horizontal and a delayed quick component. The pendular movements are more marked on looking to the side of the lesion which is the opposite to that which is observed in lesions of the labyrinth alone. The ataxic movement can be reduced or eliminated

by the application of lenses of 18 diopters. Cerebellar nystagmus persists and may be present even when the patient feels well and capable of resuming his occupation.

One must not place much significance upon post-rotational nystagmus of short duration or nystagmus that requires in its production douching with water at 68°F. for a longer period than is necessary with the normal labyrinth. Such lack of sensitiveness or delay in response is a common finding after head injury. Whether it is due to mild lesions of the vestibular pathways cannot be said. When however, the horizontal semicircular canals respond with nystagmus and not the vertical canals, intracranial disturbance must be suspected. When such a finding is associated with profound unilateral deafness, tumor of the cerebellopontine angle must be considered. In the later stages of such a tumor, hearing and vestibular responses are practically obliterated and the responses to stimulation of the vertical canals of the opposite side give delayed or shortened nystagmus or not at all. The reduction of hearing in cases of head injury is usually bilateral and rarely is the function of one

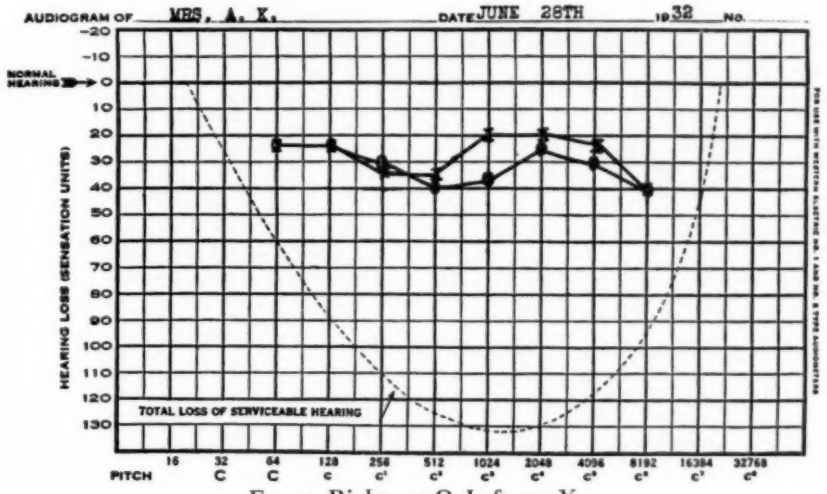
AUDIOGRAM OF MRS. A. K.
DATE JUNE 28TH 1932 NO.
NORMAL HEARING
HEARING LOSS (SENSATION UNITS)
TOTAL LOSS OF SERVICEABLE HEARING
PITCH
16 32 64 128 256 512 1024 2048 4096 8192 16384 32768
C C c c' c² c³ c⁴ c⁵ c⁶ c⁷ c⁸

Fig. 1. Right ear O. Left ear X.

256 D.V.	Air	10 sec.	11 sec.
	Bone	6 sec.	7 sec.

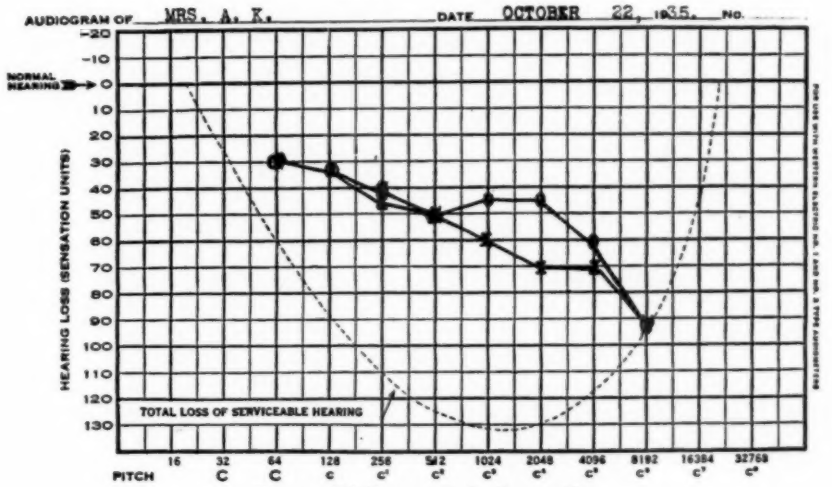
AUDIOGRAM OF MRS. A. K.
DATE OCTOBER 22, 1935. NO.
NORMAL HEARING
HEARING LOSS (SENSATION UNITS)
TOTAL LOSS OF SERVICEABLE HEARING
PITCH
16 32 64 128 256 512 1024 2048 4096 8192 16384 32768
C C c c' c² c³ c⁴ c⁵ c⁶ c⁷ c⁸

Fig. 2. Right ear O. Left ear X.

128 D.V.	Air	10 sec.	7 sec.
	Bone	7 sec.	6 sec.
256 D.V.	Air	6 sec.	9 sec.
	Bone	4 sec.	5 sec.

or the other labyrinth completely nullified. In head injury a lack of response from the vertical canals is most likely due to damage of the vestibulo-ocular pathways. An induced nystagmus that is rotary when it should be horizontal or a nystagmus that moves in a direction opposite to that which is normally to be expected may be considered to be due to injury to the intracranial pathways or the nuclei which control the mechanism.

Past-pointing. Very rarely, within a period of three days following concussion spontaneous past-pointing may be found. This sign quickly disappears unless there has been severe damage to the cerebellum or its afferent and efferent pathways. Then it is associated with so-called cerebellar nystagmus. The spontaneous past-pointing arising from injury to the end-organ is never of long duration. Induced past-pointing in postconcussional cases is rarely normal. It is not as reliable as nystagmus because it may be influenced subjectively in the same way as the determination of the hearing acuity. When it is abnormal and not accompanied by perspiration, nausea, vomiting and falling from turning or prolonged caloric stimulation its authenticity cannot be questioned. In mild cases the past-pointing is not abnormal in direction nor is it absent but it is likely to be short in duration and extent. In the more severe cases, most of them come within this category, it does not occur at all, or it is shortened, or the direction is contrary to expectation.[2,3] Both arms are supposed to past-point after douching or rotation to the side turned or douched. It is common to observe one arm pointing to the right and the other to the left or no past-pointing at all after stimulation of the right semicircular canals and vice versa. Abnormal induced past-pointing may be elicited years after the injury.

After-turning Vertigo. The determination of the duration and direction of induced vertigo is of importance. When abnormal, it confirms and strengthens the value of induced past-pointing. Abnormal induced vertigo is found nearly as often as abnormal past-pointing. The direction of after-turning vertigo may be wrong or the duration shortened and the direction correct. In the severe cases both the direction of the vertigo and the duration are abnormal. The patient with the head upright is turned ten times in ten seconds. While he is being turned he repeats constantly in what direction he is going. The chair is stopped gently and the patient who is normal repeats that he is going in the opposite direction and continues to repeat the direction until the sensation of movement disappears. The duration is the time that the patient senses that he is rotating after the chair has stopped. In a great many cases of head injury the patient indicates that he is rotating in one direction when he should feel that he is turning in the opposite direction. The importance of this test lies in the fact that the patient cannot influence the result unless the performance is badly managed.

Positive Romberg, dysmetria, adiadochocinesis, faulty finger to finger and finger to nose test, paralysis, unstable equilibrium and falling are encountered following the more severe head injuries. All of these except paralysis of the cranial nerves and falling, are to be considered of cerebellar origin, indicating that either the cerebellum or the pathways that lead to the cerebellum have been damaged. Falling may or may not be of cerebellar origin. When it disappears soon after the accident it is likely to have been of vestibular origin but its persistence indicates that the subtentorial structures have been damaged. When the static-kinetic labyrinth has been severely injured and accompanied by either temporary or permanent suspension of function, the direction of the fall changes with an alteration of the position of the head. Falling from labyrinthine injury disappears quickly, but it can be induced by quick and unusual movements of the head or body. Cerebellar falling is characterized by its persistence and by the fact that the

patient will fall in one direction no matter what the position of the head may be.

Vertigo may be true or false. True or systematized vertigo is wherein objects appear to revolve around the subject in a definite direction and is associated with disturbances of the end-organ. Usually associated with this are spontaneous nystagmus, past-pointing and falling but only in the early days after head injury. False or non-systematized vertigo is a feeling of confusion or uncertainty. Patients describe it variously as giddiness, unsteadiness, wavering of objects, a feeling that the head is going up and down, the sensation that objects are receding and mental confusion under stress especially in crowds. It is a summation of the results of the various disturbances that persist after concussion. The great majority of patients who have suffered moderate or severe concussion complain of this symptom which persists for months and even years after the injury. It is considered to be due to a derangement of the ocular, tactile or joint-muscle sense or a combination of these originating from injury to the vestibular pathways and cerebellum unless normal responses are obtained from vestibular stimulation. Only when the result of such an examination is negative can we consider that the vertigo is of psychogenic origin.

People who complain of posttraumatic vertigo originating from injury to the brain stem and cerebellum should not be allowed to resume their occupations if that entails working at elevated and unprotected positions such as house painters, steel workers and the like. The mental confusion incident to an attack of giddiness may be sufficiently profound to allow accidental falling thereby endangering the life of the patient and those with whom he is immediately in contact.

The following case histories illustrate some of the points in the text.

CASE REPORTS

Case 1. Mr. M. M., sixty-four years of age, was first seen, December 18, 1928, complaining of deafness in the left ear, dizziness and a sensation that he was about to fall.

Two years previously he was hit by a taxicab, knocked down and then became unconscious. Upon regaining consciousness he vomited and was taken to Mount Sinai Hospital where he remained for two weeks. A summary of the record of the hospital is as follows.

Physical Examination. Patient is a middle aged man lying in bed, semistuporous but can be aroused and responds when aroused although somewhat confused and inarticulate. Muscularly, he is well developed. The skin is clear and moist. There is a small laceration on the front and left parietal region which is tender and boggy, but negative on percussion. The pupils are equal and regular, react sluggishly, movements under control. The nasal areas of the ocular conjunctiva are edematous. The fundi are normal. There are blood clots in the anterior nares, the mucous membrane is congested. The appearance of the ear drums is normal. The pharynx is full of blood clots. There is a left facial weakness and a definite obliteration of the nasolabial fold. The apex of the heart is barely palpated in the fifth interspace, the borders are not enlarged, the sound is distant and no murmurs were heard. A small skin discoloration was seen over the left hip. There was tenderness over the left greater trochanter with inability to circumduct the left hip. Motion of the legs, etc., were normal.

Neurological. Positive findings were rigidity of the neck on flexion, left facial weakness, deviation of tongue to the right, sluggish abdominal and cremasteric reflexes, as well as sluggish pupillar reflexes.

Provisional Diagnosis. Possible intracranial injury; fracture of two ribs posteriorly on the left side; contusion of the region of the left hip joint.

Ear examination, December 12, 1926. Drums are intact. Canals are normal. There is no evidence of injury in either tympanum. The hearing in the right ear is very good to a soft whisper. There is a marked edema and tenderness over the left mastoid. Patient does not hear a forced whisper in the left ear. Patient is totally deaf, left ear to noise apparatus. There is spontaneous nystagmus directed to the right. There is also some vertical nystagmus upwards and to the right. The defect in hearing, the peripheral facial palsy

together with the labyrinthine nystagmus could be explained by a fracture through the petrous portion of the temporal bone involving both the labyrinth and the facial nerve.

December 10. Lumbar tap was done first drawing off about 10 c.c. bloody fluid under markedly increased tension. About 30 c.c. bloody fluid in all was removed under normal tension.

The result of my examination two years and four months later is as follows.

There is no evidence of facial paralysis. The left ear is stone deaf and a mild depreciation of hearing on the right. The pupils are irregular but react to light and accommodation. There is no spontaneous nystagmus, past-pointing or falling and the after-turning nystagmus is shortened for both sides. On rotation to the right he past-points 3 inches to the right with the right and touches with the left. On rotation to the left he past-points slightly to the right with the right arm and 5 inches to the left with the left. Douching demonstrates that there is no response from the left side and the right vertical canals do not respond to prolonged stimulation.

Diagnosis. From the evidence it may be said that this patient is suffering from a complete destruction of the left cochlea and static-kinetic labyrinth due either to fracture of the petrous portion of the temporal bone or laceration of the auditory nerve. In addition, there is evidence that the vestibular pathways have suffered a permanent injury.

Case II. Mr. W. G., twenty-three years of age was first seen on May 5, 1934, complaining of giddiness, difficulty in hearing especially with the right ear and pain in the back on motion.

On December 14, 1933 he fell down an elevator shaft for the distance of 25 feet, landing on his back and the back of the head, more on the right side where he sustained a scalp wound. He did not become unconscious but suffered with vertigo of a systematized character, directly after the injury. This disappeared in two to three days and then he became conscious of difficulty in hearing in the right ear.

Physical Examination. The right eye has an adherent and scarred iris due to previous injury. The left pupil reacts to light. The drums are normal in appearance. He has tenderness over the right mastoid and tenderness on pressure of the muscles extending from the base of the skull and attached to the scapula on the right side. There is no spontaneous nystagmus. He past-points spontaneously with the right arm 1½ inches to the right and touches with the left. In the Romberg position he sways to the right and if his feet remain together he would fall unless he saves himself by spreading his feet apart. He falls to the right, no matter in which position the head is turned. With the horizontal semicircular canals in the horizontal plane, on rotation to the right he develops a rotary nystagmus to the left which lasts nineteen seconds. On rotation to the left he develops a rotary nystagmus to the right which lasts twenty seconds. Also to be noted is that the nystagmus is rotary instead of horizontal. With the vertical canals in the horizontal plane there is no falling after rotation in either direction. On rotation to the right there is no past-pointing with either hand. On rotation to the left he past-points one foot to the right with the right and touches with the left. This direction of past-pointing is opposite to that which is found normally. On rotation to the right there is no after-turning vertigo. On rotation to the left he still feels that he is turning to the left after the chair has stopped. The duration of the after-turning vertigo was twenty-seven seconds.

Diagnosis. Chronic traumatic periostitis of the right mastoid and chronic myositis. The giddiness, hearing loss and abnormal neuro-otological findings are due to injury of brain-stem and cerebellum, more particularly on the right side.

Case III. Miss M. M., twenty-seven years of age, first seen April 5, 1933, complained of pain at the vertex more on the right side and also the forehead. Dizziness has been more or less constant and she feels as though she will fall forward. For the past eight months she has not heard well with the right ear and has tinnitus.

Present History. On November 29, 1932 she was struck on the head by an object weighing about one hundred pounds. She did not faint or fall but about three hours after the injury had a severe epistaxis. Four hours after the injury she vomited.

Physical Examination. There is a slit-like perforation in the right drum, otherwise it is normal. The left drum is normal. There is adiadochocinesis of the right hand. There is no

spontaneous nystagmus or past-pointing. The pelvic girdle reactions are not prompt. There is a marked tendency to fall forward or backward on slight propulsion. The hearing on the right side is markedly depressed, particularly in the upper half of the tone scale. The hearing on the left side is moderately diminished. On rotation, the head became loose on the neck so that it rolled on the shoulders as the rotation was being performed. There was no nystagmus after rotation, but rotation was followed by marked dizziness. On rotation to the right she past-pointed slightly to the right and touched with the left. On rotation to the left she past-pointed 3 inches to the left with the left and touched with the right. Because of the peculiar lack of tonus in the muscles of the neck the examination was discontinued at the insistence of her mother.

Diagnosis. Because of the incompleteness of the examination the only deduction that can be made is that this patient suffered an injury to the pathways which convey impulses to the muscles of the eye. In other words the vestibulo-ocular reflex had been abolished. It is likely also that she sustained an injury to the pathways which lead to and from the cerebellum or the cerebellar nuclei particularly on the right side. It is doubtful whether this patient will ever be able to work at an elevated positon as her unsteadiness will make her liable to injury by falling.

Case iv. Mrs. A. K., forty-seven years of age was first seen June 28, 1932. June 17, 1932, her car was hit by another, she became unconscious and awakened in an ambulance. Her lower limbs were paralyzed for three hours and then she was able to walk. There were bruises and cuts on her head and body. Since the accident she cannot hear well and her memory has become poor. She does not remember having had trouble with her ears prior to the accident. She has dizziness and at times has a sensation of falling. In addition to this she complains of constant headache and some difficulty in seeing. Except for falling on attempt to overthrow backward, there are no spontaneous symptoms. Rotation reveals normal vestibulo-ocular responses from stimulation of the horizontal canals. There is slight falling after rotation with the vertical canals in the horizontal plane. On rotation to the right in this position, severe vomiting occurred. Slight vertigo and no vomiting was experienced on rotation to the left in this position. The past-pointing was shortened in extent and duration, but the direction was normal on both sides. There was a moderate bilateral loss of hearing throughout the tone range. Both air and bone conduction were shortened.

Summary. Abnormal pelvic girdle reaction on pushing backward; bilateral, mild hearing loss; reduced reaction to rotation of the vertical semicircular canals; and past-pointing diminished as to extent and duration on both sides.

Diagnosis. Injury to brain stem and cerebellum.

Prognosis. Condition is permanent and likely to become worse.

This patient returned on October 22, 1935, three years and four months after the first consultation, complaining of progressive loss of hearing, dizziness, unsteadiness and repeated headaches. The hearing loss is much worse than on the previous examination (see audiograms, Figures 1 and 2). The air and bone conduction remain shortened. The fundi are normal. There is a defect in the left pupil which has been present from birth. There is a spontaneous nystagmus to the right on looking to the right, and a tendency to fall to the right in the Romberg position. This falling is not influenced by change in position of the head. With the eyes closed and the feet spread apart on pushing backward she falls backward. On pushing to the left she sways to the left and falls to the right. On rotation with the horizontal canals in the horizontal plane, the nystagmus is normal from both sides. The after-turning vertigo is shortened as to the duration, but the direction is normal on both sides. On rotation with the vertical canals in the horizontal plane, the falling is slight and the direction is normal. The past-pointing after rotation to the right is 1½ feet to the right and absent on the left. The past-pointing after rotation to the left is 8 inches to the left with the right and 4 inches to the left with the left. On douching the right ear with the horizontal canals in the horizontal plane, a fine horizontal, rather than a rotary, nystagmus to the left of thirty seconds duration is obtained. With the head back the nystagmus is large, horizontal, and to the left. On douching the left ear with the horizontal canal in the horizontal plane, the nystagmus is large, rotary to the right of twenty seconds duration. With the head back, the nystagmus is large, horizontal,

and to the right. On douching the right ear no past-pointing is elicited with the right arm. The left arm past-points slightly to the right. No past-pointing is produced after douching the left ear.

Summary. Since the examination of over three years ago, there has been a marked change for the worse in the neuro-otological picture, namely, spontaneous falling, abnormal pelvic girdle reactions, spontaneous nystagmus, a perverted nystagmus after douching the right ear and markedly reduced reactions to past-pointing from stimulation to both sides. There has been a marked increase in the hearing loss.

Diagnosis. The original diagnosis is confirmed and the prognosis as to the permanency of the condition strengthened.

CONCLUSION

It has been shown that head injuries accompanied by commotio cerebri have as their symptoms, among others, disorientation and impairments of hearing.

Paralysis of cranial and perepheral nerves is common when the injury is of a more severe degree.

The disturbances of function of the auditory and static-kinetic end-organs are not as common as injuries to the pathways that lead to the brain stem and cerebellum.

The effects of injuries to the brain stem and cerebellum are permanent and are likely to become worse in time.

A worker who has sustained a head injury is likely to fall from elevated and unprotected positions because of giddiness and instability.

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EDEMA OF UPPER EXTREMITY IN CARCINOMA OF MAMMARY GLAND

ITS PREVENTION IN SOME CASES

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THE lymphatics constitute one of the big problems in malignant disease. The lymphatics of the mammary gland are of special interest and importance in carcinoma of the breast because of their wide distribution and communication with the lymphatic system through (1) the axillary nodes, (2) the perforating vessels of the anterior chest wall, (3) other vessels in relation to the sheath of the rectus abdominalis muscle to the epigastric triangle and the peritoneal cavity and (4) the lymphatic communication with the opposite breast.

Metastasis of carcinoma of the breast may take place by way of any of these routes, but the most frequent course is to the axillary nodes. Most of the lymph from the breast passes to the axillary nodes and it is in these nodes which are accessible, especially in thin individuals, to the palpating fingers that we feel for any early signs of manifestation that the disease has passed beyond the limits of the breast.

An absence of palpable axillary nodes in the presence of disease of the breast does not mean necessarily that these nodes are free from invasion. And, also, it may be said that even though the nodes may be palpable one cannot state positively that the nodes are the seat of malignant disease. Palpable axillary nodes associated with a definite diagnosis of carcinoma of the breast are to be regarded almost always as invaded by the malignant process.

Edema of the upper extremity is associated with 20 per cent of advanced cases of carcinoma of the breast, and it occurs in 10 per cent of patients on whom radical breast operations have been performed. The edema in the advanced and inoperable cases is caused by extensive carcinomatous invasion of the lymphatics of the axilla and the subcutaneous tissues of that area. In the early stage of edema the lymph is usually confined within the lymphatics, but later as the disease progresses the lymph escapes into the surrounding tissues with extensive fibrous connective tissue formation.

There may be in a few instances an associated venous stasis in the upper extremity when the diseased axillary nodes compress the axillary vein, or when that vein has been injured during the performance of the operation.

The degree of edema varies and may be limited to certain regions of the upper extremity depending on the invasion or destruction of regional lymphatics. Where the edema is caused by the malignant disease it is progressive.

The superficial lymphatics in the forearm and arm are separated from the deep lymphatics by the deep fascia. The lymphatics from the anterior and inner regions of the hand and forearm pass to the epitrochlear nodes and then to the axillary nodes. The lymphatics from the outer and the posterior areas of the hand, forearm, and some from the arm pass to the pecterodeltoid nodes in the depression between the deltoid and the pectoralis major muscle. These lymphatics continue to accompany the cephalic vein in its course and the lymphatics join the nodes in relation with the costocoracoid membrane, and these latter nodes have connections with the supraclavicular and the inferior cervical nodes. The lymphatics of the outer and

posterior areas of the arm, and also most of the lymphatics in the region of the shoulder join the subscapular nodes.

The lymphatics from the anterior and the posterior regions of the breast are closely connected with the lymphatics in the sheath of the pectoralis major muscle and it is necessary to remove this muscle except the part that arises from the clavicle. In some cases the lymphatics from the upper part of the breast pass directly to the cervical nodes in the anterior triangle of the neck, or they connect directly with the supraclavicular nodes. The system of communication of the lymphatic vessels between the two breasts are connected by a plexus located in the midline of the body.

The arrangement of the axillary nodes is variable. Cheatle and Cutler state,

> the axillary lymph nodes are about twelve in number and they are arranged in four sets. A median set three or more in number along the course of the axillary artery and vein. An inner or anterior set, four or five in number situated below the great pectoral muscle in the course of the long thoracic artery on the outer surface of the serratus magnus (pectoral nodes). A posterior or external set, usually two in number, situated along the course of the subscapular artery under cover of the latissimus dorsi muscle (subscapular nodes). A superior set, usually two in number, situated just below the clavicle close to the cephalic vein upon the costo-coracoid membrane in the fossa beneath pectoralis major and deltoid muscles (subclavian or infraclavicular nodes).

The time of onset of invasion of the lymph nodes in carcinoma of the breast varies greatly. The nodes are, of course, invaded for a considerable period of time before they are palpable. In some instances in the presence of a highly malignant tumor the nodes may be palpable very early. Then there is the slow growing tumor, which usually occurs in elderly women, and the tumor in which the connective tissue predominates, which may not give rise to metastasis for one, two or three years.

The upper and outer or axillary zone is the most frequent site for carcinoma of the breast. Therefore, when the axillary lymph nodes are invaded by emboli, and the disease has extended by permeation of the lymphatics of the skin and the subcutaneous tissues there may be an early edema of the surrounding skin over the diseased area of the breast, edema of the breast itself, or lastly, edema of the upper extremity. The edema may exist separately in any of those areas. Demonstrable carcinomatous invasion of the skin for a distance of 5 cm. or 7 cm. beyond the periphery of a tumor that would be otherwise operable is a contraindication for operation.

Edema of the upper extremity that occurs following radical operation on the breast may be caused by (1) incomplete removal of carcinomatous invaded lymph nodes and diseased skin with the subcutaneous tissues, (2) complete removal of the lymphatics of the axilla and the associated nodes, or (3) the result of lymphatic obstruction caused by tissue scar contraction following a badly placed incision, one that falls within the axillary space and which is the most frequent cause of edema of the upper extremity whether the radical operation was performed for malignant or benign disease of the breast. An error in diagnosis or lack of investigation was responsible for the benign cases.

Figure 1 shows the type of incisions, in only their upper extremity, that are more frequently associated with edema of the upper extremity. *A* extends across the anterior region of the shoulder, and *b* is along the axillary border. Each of these incisions, after the removal of the breast, usually fall, within the axillary space and results in contraction and in many instances, holds the arm close to the thorax. *C* is composed of two incisions, at right angle to each other, and the limb which extends from the clavicle to the axilla is likely to cause lymphatic obstruction. The incision is in a measure subject to the condition found in the breast, but in opera-

tive cases the operator has a choice of location of the incision.

Figure 2 (*d*) is placed traversely and

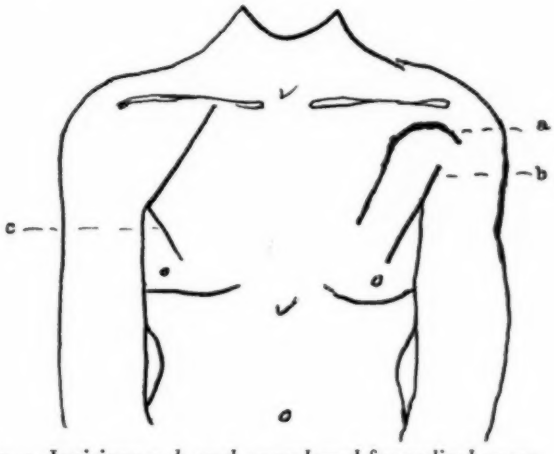

Fig. 1. Incisions *a*, *b*, and *c* employed for radical operation on the mammary gland are those most frequently associated with edema of the upper extremity. Incision *a* extends over the anterior surface of the shoulder, *b* and *c* fall into the axillary space.

least likely to cause lymphatic obstruction, and at the same time by retraction of the incision the lymph nodes can be removed. Incision (*e*) is placed slightly oblique from the breast to the infraclavicular region and will permit ready access to all regional lymph nodes.

Some of these scars, although they may not cause edema of the arm, are often the cause of a crippling impairment of arm function. Operations performed on the breast in which efforts have been made to preserve arm functional movements have given great comfort to many of these women.

The detection of a tumor in the breast is an indication for a prompt investigation. Roentgen ray examination of the breast furnishes most valuable information whether for the purpose of diagnosis, as an aid to a proposed operation, or to determine the operability, the presence of metastasis, and finally for the employment of roentgen ray treatment. A roentgen ray study should include an examination of the other breast. Transillumination of the breast, a method introduced by Cutler, is another important aid in breast diagnosis.

There remains another procedure, surgical exposure and examination of the tumor, for the surgeon to employ in cases which

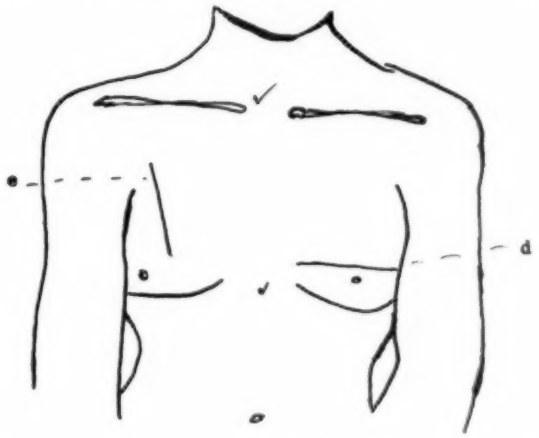

Fig. 2. Incisions *d* and *e* when employed for radical operation on the mammary gland are rarely followed by edema of the upper extremity. Incision *d* has for its center the mammary tumor, and the oblique incision *e* does not encroach on the axillary structures. Incision *d* is transverse.

have not been definitely diagnosed by the aforementioned method.

The patient is prepared for operation and an anesthetic for the extirpation of the entire tumor if that only is necessary or for a complete radical operation when indicated. The surgeon can often decide the diagnosis of the tumor, but in some of these early cases and for lymph node involvement the services of a trained pathologist are absolutely essential. For examination and diagnosis the tumors of the anterior part of the breast or those just beneath the skin are usually exposed by an anterior incision. Tumors within the gland or those that occupy the posterior part of the organ may be exposed preferably by an incision parallel with and through the inframammary sulcus. Further operative procedure will depend on the diagnosis that has been reached.

A better selection of cases for operation by a thorough study of each individual patient, with avoidance of radical operation in patients with benign disease of the breast, and by planning the incision so that it will not fall within the axillary space

comprise measures which will lessen materially the occurrence of edema of the upper extremity. Furthermore, an operation that will convert an ambulant patient into one that is likely to become housefast and in some instances bedfast should not be performed.

SUMMARY

Edema of the upper extremity occurs in 20 per cent of cases of advanced carcinoma of the mammary gland, and in 10 per cent of cases following radical operation for this disease. The edema following radical operation may be caused by previous malignant invasion of the tissues, or it may be due to a badly placed incision, namely, an incision that produces obstruction of the lymphatics from the upper extremity. Incisions with scar tissue contraction that fall within the axillary space are the most frequent cause of edema of the upper extremity. A large number of cases of edema of the arm have occurred as a result of radical operations that have been performed for benign disease of the breast. A careful study of all cases of tumor of the breast, and a planned incision for each case should help to lessen the number of cases of edema of the upper extremity following operation on the mammary gland.

TREATMENT OF CARBUNCLE WITH SHORT WAVE DIATHERMY AND CAUTERY PUNCTURE*

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THE fact that striking symptomatic relief occurred, the clinical course shortened and apparent systemic complication avoided has prompted this report on the use of short wave diathermy and cautery puncture in the treatment of 3 cases of carbuncle of the neck. In 2 of the cases, despite the actual inflammatory lesion, pain was the chief complaint and the reason for admission and its relief within thirty minutes after the application of the high frequency therapy without the use of sedatives is worth remarking.

Although some investigators have claimed certain specific biologic or bactericidal actions for short wave, its thermal properties only were the basis for use in these cases. The frequently mentioned contraindication in acute non-draining infection was also kept in mind and to meet this condition the use of cautery puncture to convert the non-draining into an externally draining cavity was adopted. In addition, the cautery was selected so that all vascular supply would be sealed off and the possibility of open blood spaces that might occur with incisions was eliminated.

It is known that high frequency currents avoid mechanical and chemical effects but have the ability to heat body tissues through which they pass. Physiologically this results in the opening of large numbers of capillaries and the increase in the rate of the blood flow through the capillaries. The acceleration of tissue metabolism is procured and there is an augumentation of the rate of exchange between blood and tissue.

The 3 cases presented lesions of the type that could have been treated in one of the three following ways; (1) excision by either scapel or electrosurgery under general anesthesia; (2) cautery puncture under general anesthesia followed by hypertonic wet dressings or the application of heat; (3) the use of bacteriophage, particularly if a bacterial strain of Staphylococcus aureus or albus is present. All the carbuncles had the usual brawny consistency studded throughout with numerous pinpoint spots exuding pus, but with no definite fluctuant areas.

The technic of the treatment is as follows. A cable is attached to the short wave machine and is given three turns at the center so as to form a circle, large enough to extend beyond the margins of the lesion. Several thicknesses of toweling are placed over this and the patient is instructed to lie down in such a manner that the carbuncle occupies the center of it. The current is turned to the point of comfortable heat tolerance and the treatment is kept up for fifteen or twenty minutes either once or twice in twenty-four hours.

The carbuncle is carefully inspected each day and as soon as any point of fluctuation is seen this is drained by puncturing with the actual cautery. No anesthesia is required as the tissues at this spot are usually so insensitive or desensitized that the patient scarcely perceives the cautery thrust. The fact that anesthesia is not necessary is important because carbuncles usually occur in old persons, frequently debilitated, and often diabetic in whom the use of an anesthetic presents a definite hazard.

The clinical courses of the cases forming the basis for this report are as follows:

* From the Jersey City Medical Center.

Case I. J. T., aged fifty-six years. One week before admission he noticed a pimple on the back of his neck which he scratched and within twenty-four hours a physician considered it advisable to incise. Notwithstanding this treatment the condition became worse so that upon admission to the hospital he presented a hard, indurated area on the back of his neck about 4 inches in diameter. There was bluish discoloration about the margins and a yellow area in the center, still firm but showing numerous small pus-draining points. The pain was very severe. A twenty-minute short wave diathermy treatment was given and in a half-hour he was very comfortable. The next day the center was fluctuant and this was drained by several cautery punctures without anesthesia. The diathermy was continued daily and as additional areas of fluctuation appeared they were punctured. The patient was discharged in thirteen days with the infection entirely cleared and only a faint pink blush to mark its site.

Case II. J. F., aged sixty-three years, complained of a painful infected swelling on the back of the neck for one week continuously increasing in size. There were a few superficial yellow areas which were points of pus ready to discharge spontaneously. The entire part was hard and indurated and measured about 3 inches in diameter. One of the small pus pockets was punctured and the culture showed Staphylococcus aureus. A short wave diathermy treatment was given at once and repeated the next day. In thirty-six hours the center area was ready for cautery puncture. This was repeated when indicated and the patient was discharged in twelve days with the infection cleared. The relief of pain soon after the first treatment was mentioned by this patient.

Case III. I. N., sixty years of age, complained of an abscess on the right side of the neck about 4 cm. in diameter for the week previous to admission. He gave a history of diabetes for eight years with irregular periods of proper supervision. When admitted he showed a moderate amount of glycosuria which at the start required ten units of insulin three times daily, gradually diminishing. Thirty-six hours after the short wave diathermy, this lesion ruptured spontaneously and did not require cautery puncture. He was discharged in one week. There was slight redness and induration but no fluctuation or pus exudate and the reason he left the hospital was because he said that he didn't feel "sick enough to stay any longer."

SUMMARY

In the discussion of these cases the ease of application of short wave diathermy as compared with the previous conventional lower frequency diathermy is noteworthy. In addition, another advantage is the comparative comfort with which persons of this age may be treated. This plan of therapy is, therefore, considered a valuable adjunct to management of cases of this type.

ACUTE APPENDICITIS

REPORT OF 757 OPERATED CASES

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NO apology is made for presenting a paper on acute appendicitis but if any excuse were needed, the apparent increase in the incidence of this disease and its appalling mortality statistics should be amply sufficient. Entirely too many members of our profession are inclined to consider this subject as ordinary and uninteresting and seem to believe that the last word has been said on the subject. We feel, however, that any disease which causes the death of as many persons as does appendicitis warrants most careful study and that a thoroughly conscientious report of a group of cases of this size will not be amiss.

It has been fifty years since Fitz gave the first really comprehensive paper on this subject. Only recently his son has presented another very valuable article, again calling attention to the seriousness of this disease and the need for careful study and consideration by the family physician and internist as well as by the surgeon. Although Osler long ago said, "there is no medical treatment for appendicitis," the general practitioner and internist have a tremendous responsibility in early diagnosis as well as education of the lay public.

Perhaps it may seem unnecessary to mention the essentials of diagnosis, combined with the warning against the use of purgatives and opiates; or to mention the increasing danger of delay after the diagnosis is made. To ignore these things will only invite disaster; to heed them will amply repay every one.

We shall attempt, without being too uninteresting, to present work done at the Employees' Hospital and try to prove that the fatality rate can be lowered.

This report includes: the age incidence, the number of males compared with females, the occurrence in negroes compared with whites and the seasonal incidence. It shows the average hospital stay, and the number of perforated and non-perforated cases. In the perforated group the ones with generalized peritonitis are compared with the ones which had frank abscess formation, giving the fatality rate of each. Brief mention is also made of the cases with and without previous attacks, and a few words seem in order about the type of incision used.

Following the suggestion made by Dr. Donald Guthrie in his editorial in the August, 1935 issue of the American Journal of Surgery, the cases reported in this paper include only cases of *acute* appendicitis. The simple routine appendectomies done while the abdomen was open for some other purpose, as well as simple appendectomies done on interval cases, have purposely been omitted.

A total of 757 cases of acute appendicitis have been operated at the Employees' Hospital since it was opened in November, 1919. Of this number 260 cases were operated by the author.

The age incidence was one of the most interesting things noted, the youngest patient being eight months. This infant had a gangrenous appendix, verified by the pathologist, which was removed at operation for intussusception. The intussusception had included or probably started at the ileocecal valve, and had interfered with the meso-appendix circulation to such an extent that the appendix was completely gangrenous. The circulation in the involved gut was only mildly embarrassed, and after the intussusception was reduced the color of the gut returned to normal, while the appendix remained "blue-black," necessitating appendectomy.

The other extreme in the age group was a patient sixty-six years of age. She recovered from a severe, diffuse, general-

ized peritonitis due to a gangrenous, ruptured appendix; the preoperative diagnosis in this case was intestinal obstruction.

The age incidence in this group supports what is generally known, that acute appendicitis is a disease of young adults. The incidence according to decades of life was as follows:

Table 1

Age groups	Cases	Deaths
1–10	81	9
11–20	313	7
21–30	210	12
31–40	102	7
41–50	33	8
51–60	16	2
61–70	2	0

The average number of days each patient stayed in the hospital was fifteen. This may seem longer than necessary or longer than the average for an ordinary abdominal operation, but there were a number of drainage cases with unusually long hospitalization, which lengthens the average. It has been our custom to keep these patients until they are ambulatory, and it is not our policy to send them home in the ambulance in four to five days. Two weeks is a long time, but it is during this period that most complications arise.

An overwhelming majority of cases occurred among the white people as compared with the negroes. There were 602 white cases of which 411 were males and 191 females; and of 155 negro cases 127 were males and 28 females.

The small number of cases of acute appendicitis among the negroes was very noticeable. We are searching for some explanation. To simply state the occurrence among the whites and among the negroes does not express the situation clearly. The normal capacity of the Employees' Hospital is 310 beds, and the average daily census of whites compared with negroes is approximately equal, or 50 per cent of each.

The admissions were from a limited territory and represented families of individuals who were on the payroll of the Tenessee Coal, Iron and Railroad Company. The estimate of whites and negroes in the employment of the Tennessee Coal, Iron and Railroad Company is about 60 per cent negroes and 40 per cent whites. In the Mining Department there is a much larger percentage of negroes; a reasonable estimate being about 70 per cent negroes and 30 per cent whites. So it is not difficult to see that this emphasizes the low percentage of occurrence of acute appendicitis in the negroes compared with the whites.

There have been several theories submitted in explanation of this low occurrence among the negroes, one being that the negroes are much more attentive to their elimination and that constipation favors stasis in the cecum as well as in the colon, and stasis favors infection. Indirectly, the original inflammation may be aggravated by improper elimination. Another favorite explanation advanced by others is that the diet of the negro is decidedly different from that of the white man. Very few negroes have the abundance of food that most white people have, and very few "live out of tin cans" to the extent that white people do. This is only advanced as a vague theory, and the explanation of the sequence of the physiological and pathological changes which occur in the appendix due to diet are not attempted here.

The seasonal incidence is not often commented, and while we have no reasonable or logical explanation for the seasonal occurrence, acute appendicitis certainly does seem to be a disease of the summer months. This might be expressed in another way and attention is called to the fact that the months in which the greater number of cases occurred were the months *following* the winter months. Table 11 shows the occurrence by months.

There was a history of previous attacks noted in 222 cases and no previous attacks in 535 cases. This may not be an accurate description of the occurrence of previous attacks because in the history unless the fact was mentioned that the patient had

TABLE II

Month	Cases	Deaths	Fatality Rate
January	63	2	3.17
February	56	3	5.35
March	47	3	6.38
April	86	6	6.97
May	71	5	7.04
June	90	5	5.55
July	80	2	2.50
August	80	4	5.00
September	53	4	7.54
October	40	4	10.00
November	50	3	6.00
December	41	4	9.75

had previous attacks that case was included in the group without previous attacks.

Two-hundred twenty-four patients, or 29.59 per cent of the total cases, showed gross perforation of the appendix at the time of operation. The high percentage of perforations deserves further comment. The statistics covering this group of cases fail to give absolutely accurate information concerning early purgation. No doubt any other member of the Surgical Staff will agree that at least 75 per cent of the cases of perforated appendicitis had had early purgatives prior to admission. The medical set up in the Tennessee Coal, Iron and Railroad Company gives the employees easy access to the local physician and the people take advantage of this service. These physicians are competent men and know full well the danger of purgatives in any type of acute abdomen and do not prescribe purgatives. The laboring classes, who make up a large majority of the employees of the Tennessee Coal, Iron and Railroad Company, are naturally the type of people who think any kind of abdominal pain can be relieved by purgatives. This, of course, is gross ignorance and is responsible for the self administered purgatives to which so many of the perforations are due. Each member of the Medical Department of the Tennessee Coal, Iron & Railroad Company is continually preaching against purgatives in questionable abdominal cases; and it is hoped that this paper will at least be stimulating to further educate the lay public along this same line.

Of these 224 perforated cases there were 48 cases of generalized peritonitis with 26 deaths, a percentage of 54.15, and 32 cases of localized abscess, with 3 deaths, a fatality rate of 9.37 per cent.

By the term "generalized peritonitis," as here used, we indicate a true purulent spreading peritonitis, with the presence of frank pus over a wide area with marked injection of all visible peritoneal surfaces.

Cases of gangrenous or suppurative appendicitis, with or without perforation and with varying collections of different types of intraperitoneal fluid, often of a purulent nature but without marked injection or exudate of peritoneal surfaces, are not included in this classification. Intraperitoneal drainage was employed in 363 cases, or in all of the 224 frank perforations, and in an additional 139 cases where bacterial penetration from a necrotic appendix was suspected.

Of recent years we have followed the general trend toward less drainage, although we are far from accepting in full the opinion of Arthur Shipley, leaning rather to a midpoint between his teaching and that of Lawson Tait, whose famous rule "when in doubt drain" has, we believe, saved many lives. We believe Guerry's statement "that Tait's rule: 'when in doubt drain' changed to 'when in doubt don't drain' may be witty after a fashion but is vicious as a surgical principle" is worth remembering. We have, of course, closed without drainage many cases of the gangrenous or suppurative type with varying amounts of serous fluid in the abdominal cavity, often with plastic exudate on the appendix.

When drains are used the soft Penrose type or the so-called cigarette drain is preferred, usually two being passed into the pelvis, care being taken to keep these drains lateral to the intestinal coils. In severe cases one or two drains are passed upward toward the liver.

The question of delayed operation must be touched. We all appreciate the futility of a few drains when the entire abdominal

cavity is involved in a spreading infection. Any type of drain functions in a very circumscribed area for a very limited period. In a desperately ill individual with a history of acute illness of more than thirty-six hours duration, board-like rigidity of the abdomen, vomiting, dehydration, rapid pulse, leucocytosis, anxious expression and semicollapse, is not conservative and supportive treatment indicated in the hope of abscess localization and a delayed simple drainage operation?

We believe that the figures presented previously: 54 per cent fatality in cases of spreading peritonitis subjected to operation, as against 9 per cent fatality in drained abscess cases, is part of the answer at least. In connection with the increase of abscess cases, with a decrease of the generalized peritonitis cases, the fatality rate is correspondingly low in the entire group over the period where the spreading generalized peritonitis cases were treated by supportive measures and a delayed operation.

In 1930 Dr. Groesbeck Walsh and I reviewed the cases of acute appendicitis which had been operated up to that time. We were surprised and disappointed to find that there had been 35 deaths of 500 cases, a fatality rate of 7 per cent. We realized that this was too high and recently in bringing this summary up to date, that is to September 1, 1935, with the addition of 257 cases, we were interested to find that there had been only 10 deaths, which gives a fatality rate of only 3.9 per cent. Of these 757 cases there were 712 recoveries and 45 deaths, or a fatality rate of 5.94 per cent.

Is there any reasonable explanation for this improvement? We believe that there is no one individual thing which can be given credit for this decrease in the fatality rate. The following things no doubt play an important part and when combined will probably give the correct answer to this question.

First of all we feel that there is a closer cooperation between the medical and surgical services and no doubt a large part of this improvement in the fatality rate is due to the careful preoperative consideration that is given these patients, not only towards making a diagnosis but also as to the operability and the risk to the patients as estimated by the Medical Service. We appreciate their cooperation, and there is no doubt that the patient has been greatly benefitted by this preoperative consideration. This, of course, leads to a more accurate diagnosis.

We feel too that the early hospitalization of these patients has helped, because now, contrary to the first few years when the hospital was opened, the vicinity that we serve is more localized. Formerly there were patients brought from a larger territory. Now the concentration of the industrial works in a closer neighborhood has facilitated the transportation of these sick patients at a more rapid rate. We feel that this has not only given earlier hospitalization, and thereby earlier operation in the unruptured cases, but also has made correct recognition of the generalized peritonitis cases easier, and has aided in giving conservative and supportive treatment which facilitated localization of the infection into abscess formation and surgical intervention at the optimum time, usually drainage only.

We also feel that a better understanding of the need of the patient after operation has aided in reducing the fatality rate. We believe that special care should be given to the fluid intake, the prevention of gastric dilatation, and the prevention of absorption from the stomach and upper intestinal tract by the use of the inlying duodenal tube, with the suction apparatus attached, as advocated by Wangensteen and also by Bartlett. We favor, too, as a postoperative measure, especially in those cases that show some peritoneal soiling, heat to the abdomen, either by coop light, electric pad or hot water bottle. We believe, also in the generous use of morphine, which does not allay peristalsis as was formerly thought. This has been definitely proven by Oschner and Gage.

As time passes and more of these cases come under our observation, we believe that considerable improvement in handling them is helping to reduce the fatality rate. We hope that our judgment about when to operate and what to do at the time of the operation has improved with experience. We will continue to make every effort toward early and correct diagnosis, early operation in the unruptured cases and continue conservative treatment and delay operation in the generalized peritonitis cases, thereby obtaining even a lower fatality rate than that quoted.

A paper of this kind, dealing with a definite pathological entity, would not be complete without some mention as to the type of incision used. A large majority, in fact practically all of these cases, were operated through a McBurney incision. Occasionally this incision had to be enlarged which, contrary to generally accepted opinion, is a most simple procedure, and there can be no question that ease of access thus secured is most valuable. There are several reasons for this. First of all we feel that the abdominal wall is much stronger afterwards, as compared with the case that is opened by the use of a rectus, Douglas, Kamerer, Battle or any of the other standard incisions that do naturally afford more room and perhaps easier exposure. These other incisions allow more abdominal contamination by permitting more loops of small gut to come into the field and become contaminated if the appendix is ruptured.

It is probably unnecessary to mention the increase in the number of incisional hernias that occur in the incisions aside from the gridiron. We have had a number of gridiron drainage cases with wound suppuration that have failed to show any muscular defects or herniation after a good many years. We consider also the class of patients in which most of these cases occurred and realize that they must return early to active manual labor. This is certainly easier and quicker in the cases that were operated through a McBurney's incision. We hope that this incision is not mistaken for what is commonly called a "button-hole" incision. We believe that easy access is usually obtained through a gridiron but not through what is commonly called a "button-hole." If the case is one for drainage we believe that lateral drainage and drainage from the pelvis and right iliac fossa is definitely facilitated by use of a gridiron incision.

We feel quite certain that some will disagree with part and perhaps with all of this presentation. It is realized that every man has a right to his own opinion. It is human nature to forget the bad results, and also quite natural to remember the successes. No doubt if any of you would make a similar summary of your own cases you would be surprised at the number and also the results.

As a closing thought it is suggested that we all study our figures and become better acquainted with our results and let that information stimulate us to a definite effort to improve those results.

SUMMARY

The fact that acute appendicitis is considered ordinary and uninteresting might be partly responsible for the fatality rate, which is certainly too high.

This report includes only cases of acute appendicitis and gives the age incidence, the number of males compared with the females, the occurrence in negroes compared with whites, the seasonal incidence, the average hospital stay and the number of perforated and non-perforated cases.

In the perforated group those with generalized peritonitis are compared with the ones which had frank abscess formation, giving the fatality rate of each. Definite evidence is presented to show that the cases which are allowed to form an abscess have a much better prognosis after operation than those cases operated with a spreading generalized peritonitis.

Reasons are given for our preference in using a McBurney incision.

Due credit is given the members of the medical service for their helpful cooperation.

ADEQUATE SURGICAL MASKING: PROBLEM AND SOLUTION

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THE pathway of aseptic surgical technic since the work of Pasteur in 1879 has led to the efficacy and end results of modern surgical endeavor. The trail has been a long and winding one and the greatest advances have been made in technical steps which were not always unresisted. The sterilizing of instruments, the thorough cleansing of hands, the use of first clean and then sterile garments to replace street clothes in the operating room, the meticulous preparation given the region to be handled and the use of rubber gloves, are all steps whose necessity we immediately recognize and accept. But when first proposed, they were not immediately granted their importance as witness the tardy acceptance of Halstead's introduction of rubber gloves in 1890, unquestionably one of the most important contributions.

The sources of operating room wound infection are the operating staff's hands, instruments, garments, materials such as sutures used in work, and nasal and oral droplet spray. The progress of surgery is dependent upon heeding the words of Sir Berkeley Moynihan,

> Every operation in surgery is an experiment in bacteriology. The success of the experiment . . . depends not only on the skill but also upon the care exercised by the surgeon in the ritual of the operation. The ritualist must not be a man unduly concerned with fixed forms and ceremonies . . . but one who refuses to be merely a mimic bound by custom and routine. He must set endeavor in continual motion, and seek always and earnestly for simpler methods and a better way.

With one exception, the sources of infection in the present day operating room are well controlled, that exception being nasal and oral droplet spray infection.

An attempt at control is made through the use of face masks, usually made of gauze. Their efficiency has been seriously questioned within recent years, and the studies of Walker and others indicate that here is a patent defect in modern operating room infection control. His investigation shows that wound infections of a Streptococcus hemolyticus nature occur with epidemics of respiratory disease and that at such times 50 per cent of operating room personnel are hemolytic streptococcus carriers. Further, that the usual gauze masks are totally inefficient and that proper masking practically eliminates hemolytic streptococcus infections. Kellogg and MacMillan found that the efficiency of the gauze masks depends upon the number of layers and fineness of mesh of the gauze. When one of sufficient density was used to exert a useful filtering influence, breathing became difficult and there was leakage at the edge. The efficiency of the gauze mask seldom exceeded 50 per cent. While Meleney showed that streptococcus carriers are most commonly met in epidemics of respiratory diseases, it is now generally accepted that they may be encountered at any time of the year. Writing on the same subject, Davis is of the opinion that an operating surgeon is not justified in omitting a single precaution for the patient when operating, and stresses inadequate masking as the weak link in the chain of operating room technique. He lists for his requirements for adequate surgical masking, a mask of impervious material which completely blocks the mouth, chin and nostrils, deflects breath spray away from the wound and is well fitting over the nose to prevent fogging of glasses.

The writer's attention was directed to the matter of adequate masking by a series

of wound infections which were traced to an assistant who was a nasopharyngeal streptococcus carrier. A repetition of Walk-

Fig. 1. Mask in use in operating room. Nose and mouth completely occluded. Rim fitted snugly but not tight over nose; tape drawn straight back over ears to prevent mask from "riding" up on the nose.

er's experiments on the transmissibility of infection through the ordinary gauze mask corroborated his notation of its inefficiency. It was also noted that many surgeons and assistants did not cover the nose, because of the personal discomfort, steaming of glasses, interference with speaking and the like. It is obvious that improper masking is little better than none. The surgical aseptic conscience must be developed fully by the surgeon himself if he would expect adherence by other members of the team to the essential carefulness upon which success depends.

Maes indicates the need of improved masking when he states that "when a fatal outcome may follow a pin prick it is obvious that the surgeon incurs serious responsibility . . . even tho every instrument is sterilized, tho in his modern operating garb he *scarcely breathes upon* his patient, and tho he touches him only thru the interven-

Fig. 2. Mask adjusted for nursing mother in upper respiratory infection prophylaxis.

tion of rubber gloves." There is no more justification for "scarcely breathing" upon a wound than there is for continuing to use a torn glove. The jeopardy is to the patient and the surgeon has no moral right to permit its existence.

The search for a mask to fulfill the requirements of the operating room as outlined by Davis culminated in the following: A mask is made of a transparent, impermeable, light weight, non-combustible substance, a cellulose derivative called "Plastacele," the upper edge of which is wedged in a pliable aluminum band in order that it might be bent to fit the shape of the wearer's nose. It is held in place by ear pieces, or cotton tapes tied around the head, in the usual manner of tying masks. That part coming under the chin is so shaped as to catch perspiration drops.

This device was tested with smoke and vapor to determine inspiratory and expiratory breath currents. It was found that most of the inspired air entered from about

the chin, while the expired air was deflected backward past the cheeks and ears. Using Walker's technic the impermeability and deflection of expiration was tested on nine persons, three of whom harbored streptococci in the mouth and nasopharynx.

A protecting box was made 18 inches high and 30 inches long, with a central transverse occluding partition for the culture plates. One open end was used for the test, the other for the controls. Three blood agar plates were placed 18 inches away from the subject at the test end, and three were placed at the control end. Reading aloud from a book for sixty minutes constituted the test, and one test and one

TABLE I

TALKING TEST—6 SUBJECTS USING 4-PLY GAUZE MASKS. NOSE AND THROAT CULTURE NEGATIVE FOR STREPTOCOCCI

	15 Min.		30 Min.		60 Min.		Number of Colonies Averaged in Controls		
	No. Positive	No. Colonies	No. Positive	No. Colonies	No. Positive	No. Colonies	15 Min.	30 Min.	60 Min.
Streptococcus hemolyticus	0	0	1	3	1	4	0	0	0
Staphylococcus aureus	2	4–7	4	8–12 14–17	5	12–12 13–9–8	2	5	4
Staphylococcus albus	0	0	4	9–5–8 11	4	10–12–8 14	0	6	7

TABLE II

TALKING TEST—3 SUBJECTS USING 4-PLY GAUZE MASKS. ALL STREPTOCOCCUS HEMOLYTICUS CARRIERS

	15 Min.		30 Min.		60 Min.		Number of Colonies Averaged in Controls		
	No. Positive	No. Colonies	No. Positive	No. Colonies	No. Positive	No. Colonies	15 Min.	30 Min.	60 Min.
Streptococcus hemolyticus	1	5	3	12–16–6	3	19–18–14	0	0	0
Staphylococcus aureus	2	9–3	2	10–15	3	23–17–12	3	4	6
Staphylococcus albus	0	0	2	12–9	2	14–19	0	5	4

TABLE III

TALKING TEST

9 SUBJECTS (6 NORMAL, 3 STREPTOCOCCUS HEMOLYTICUS CARRIERS)

TESTS MADE USING NEW IMPERVIOUS MASK

	15 Min.		30 Min.		60 Min.		Number of Colonies Averaged in Controls		
	No. Positive	No. Colonies	No. Positive	No. Colonies	No. Positive	No. Colonies	15 Min.	30 Min.	60 Min.
Streptococcus hemolyticus	0	0	0	0	0	0	0	0	0
Staphylococcus aureus	1	2	2	1–3	2	2–2	3	2	5
Staphylococcus albus	0	0	2	3–3	3	2–2–4	1	4	5

control culture plates were removed simultaneously in fifteen, thirty and sixty minutes.

The first group series was run with the subject using four ply gauze operating room masks, the second using the impervious mask described.

The results of the first group are given in the tables. In the second, employing the new impervious mask, *there were no instances where the test plates showed colonies in excess of the control plates.* There were no hemolytic streptococcus growths in any of the test plates where the new mask was employed.

The absence of blood-agar plate contamination with the new impervious mask is strikingly demonstrated, in contrast to the results obtained with the gauze mask. These demonstrate the most important feature, the protection of the patient.

Some lesser advantageous features became apparent during the experimental use of this mask. There was neither steaming of glasses nor fogging of vision, the face could be seen, facial expressions noted and words heard clearly. Constant wiping of perspiration from the face and neck is unnecessary, for readily replaceable pledgets of absorbent cotton one inch square in the "floor" of the mask suffice to prevent contamination of the sterile field. It is readily cleansed in soapy water, sterile water or the ordinary aqueous solutions of antiseptics. It is inexpensive in continual use for its durability makes its life dependent upon the ordinary handling it receives. In operation, its cost over its lifetime approximates the inefficient permeable gauze masks in common use. When put on and adjusted properly, it is found to be most comfortable when used over long periods of time.

CONCLUSIONS

1. Improper surgical masking has constituted a persistent weak link in the chain of aseptic operative technic.

2. The infrequency and seasonal occurrence of nasal and oral borne wound infections do not lessen their severity when they occur and constant "carriers" are met all times of the year.

3. A mask to be effective must fulfill the requirements outlined by Davis.

4. Such a mask, made of impervious, bacteria proof material, with proper breath deflections, is herein offered for use in operating rooms and where proper masking is desired.

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STRANGULATED INGUINAL HERNIAS IN PREMATURE INFANTS*

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EIGHT hundred and thirty infants who have been graduated from the premature station at Sarah Morris Hospital to the Out-Patient Clinic comprise the material for this study. Thirty-eight infants had 44 inguinal hernias, an incidence of 4.8 per cent. In 6 of these infants, strangulation or incarceration of the hernial sac contents necessitated surgical intervention. Because we feel that the incidence of this complication is greater than has been supposed, and because of our relatively good surgical results, we believe that a detailed report of these cases would be of interest.

Until recently it was felt that strangulation of inguinal hernias in infants was very rare. Herzfeld,[1] in her series of 1500 herniorrhaphies in children, found only 3 instances of strangulation. Fuld[2] reported only one strangulation in 1200 children examined for hernia. Nussbaum[3] saw only 2 instances of this complication in 54,000 children. Frankau,[4] who studied a total of 1487 case records of strangulated hernias, found only 38 cases in infants under two years of age. On the other hand, Krause[5] has operated upon 6 infants to relieve incarceration and believes the incidence as high as 10 per cent. Porter and Carter[6] think the incidence is between 5 and 7 per cent. Deutsch,[7] in a series of 780 hernia repairs, had 29 incarcerations. More recently, isolated case reports have been not uncommon in the literature.

Our own incidence of strangulation of 13.6 per cent[8] is higher than that reported in any similar group. Few if any reports differentiate between full term and premature infants. Whether any such distinction can be made is a question we cannot answer. Our figures show that uncomplicated hernias are not more frequent in infants prematurely born.

Four of the 6 infants were males and 2 females. Their ages varied from forty-eight days to two years, 5 of the 6 being under three months of age. Birth weights varied from 1430 to 2065 grams, the average being 1810 grams. We do not believe that the smaller infants are necessarily more liable to strangulation, although the percentage of uncomplicated hernias was slightly higher in the smallest weight group, under 1000 grams. Likewise the age of gestation seemed to bear no relation to the incidence of strangulation.

Four of the strangulations occurred on the left side, 2 on the right, in spite of the fact that in our entire series of uncomplicated hernias 58 per cent were right sided. This, we think, is purely coincidental.

The existence of an open peritoneal process per se is not the most important cause of strangulation. The coexistence of one or more causes of increased intra-abdominal pressure is more important. Such pressure on the immature abdominal wall musculature will produce herniation through its weakest point. These causes are many, including excessive crying, cough, vomiting, constipation, diarrhea, breath holding, and phimosis. In some cases, more than one cause was present.

Agreement is practically universal regarding the role of the first 4 causes. Phimosis has been disputed; Kelley[9] and Herzfeld[1] believe it important, but Coley[10] and Morse[11] do not. We observed the difficulty with which some of these infants forced a few drops of urine through pinpoint sized preputial openings, and could not help but regard this a significant factor. Accordingly, we circumcised 8 in-

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fants immediately upon the appearance of uncomplicated hernia. To date 7 of these remain permanently cured, 5 after immediate disappearance of the herniation, and in 2 the hernias disappeared within a few days. In one infant, with large bilateral, difficulty reducible hernias, the improvement was immediate and marked, so that trusses easily controlled the small, reducible masses. These striking results made us conclude that phimosis is a definite cause of hernia and a predisposing cause of incarceration.

The direct cause of incarceration of a hernia already present is of course not known. In 4 of our 6 infants, it immediately followed the original appearance of the hernia, and in one it followed several days later. This seems to indicate that newly acquired hernias are more liable to incarceration than older existing ones.

CASE REPORTS

Case I. Y. A., female, aged two and one-half months, birth weight 1785 grams, present weight 2895 grams had an irreducible mass in the left groin for twelve hours, with abdominal distention and vomiting. The hernia had protruded several times during the previous three days but had been easily reduced. Operation was done under drop ether anesthesia making the usual herniotomy incision. The sac was found to contain the left tube and ovary and a portion of the uterus. These were freed and replaced and the sac transfixed and ligated. An Andrews' imbrication repair was done using chronic catgut and the skin closed with clips. The baby left the hospital sixteen days later after an uneventful convalescence.

Case II. E. P., male, aged two years, birth weight 1430 grams presented no herniation until fourteen hours before admission when a tender mass was noticed in the left groin. There was distension and obstipation, but no vomiting. Operation was done under ether anesthesia; the sac was isolated and found to contain a dusky loop of ileum which promptly regained its color after it was released. The sac was ligated and an Andrews' imbrication repair was done. Convalescence was without incident and the patient left the hospital after sixteen days.

Case III. S. P., male, aged two months, birth weight 1930 grams, weight at two months 2890 grams. The hernia was noticed first at the age of three weeks but had always reduced very readily. Eighteen hours prior to admission a very tender mass appeared in the right groin. The father partially reduced it about six hours after its appearance. Vomiting began twelve hours before admission. At operation under drop ether anesthesia, a viable loop of ileum which was found in the sac was replaced. After ligating the sac a Bassini repair was done. The sac of a small hydrocele was inverted and a circumcision was done. The convalescence was uneventful. The hospital stay was twelve days.

Case IV. R. B., female, three months old, birth weight 2025 grams, weight at three months 3180 grams. Vomiting began twenty-four hours and a mass in the left groin was first noted eight hours before admission. The child had had no bowel movement for thirty-six hours and was markedly distended. At operation under ether anesthesia, the sac was found to contain a markedly edematous left ovary and tube and the fundus uteri, which were replaced with difficulty. The sac was ligated, Kocherized and a Bassini repair was done using plain catgut. The baby left the hospital on the eleventh day after an uneventful convalescence.

Case V. E. R., male, aged ten weeks, birth weight 1630 grams, weight at ten weeks 2600 grams. Vomiting began sixteen hours before admission and was accompanied by distension and obstipation. A tender mass in the right groin was noted for the first time soon after the onset of symptoms. The infant was in marked shock, the breathing so slow and shallow that ether could not be administered. Infiltration with ½ per cent solution of procaine was used. The sac contained dusky, but viable cecum, terminal ileum, and appendix. These were replaced, the sac ligated and Kocherized and a Bassini repair was done using plain catgut sutures. The postoperative condition was poor but after several hours in an oxygen incubator, it improved. The child left the hospital on the twenty-sixth day, weight 2950 grams.

Case VI. R. T., male, aged forty-five days, weight 2595 grams. For three days the infant vomited every feeding. It had a bowel movement sixteen hours prior to admission. Its

color was only fair, it was markedly dehydrated and in shock. The left sided hernia had appeared for the first time twenty-four hours previously. At operation under ether which was poorly taken, the sac containing the dusky but viable large bowel and considerable fluid, was replaced, the sac ligated, and a Bassini repair was done using chronic catgut. The child's condition was very poor and it died five hours postoperatively, in spite of intensive treatment.

TREATMENT

Conservative treatment of inguinal hernias as a means of preventing strangulation is important. Most hernias in infants will heal if the underlying cause of the increase in intra-abdominal tension is relieved, and if yarn or soft rubber trusses as advocated by Hess[12] are correctly used. Where rapid and complete relief of the increased pressure can be obtained, as by circumcision for phimosis, or surgical relief of an imperforate anus, trusses are often unnecessary. When cough, abnormal crying, constipation, diarrhea, or other predisposing causes occur, they should be promptly tended, and at such times, trusses should be watched carefully to be sure that they are efficient.

Treatment of incarceration or strangulation that has already occurred may be conservative or radical. Some years ago conservative measures were the rule, now the feeling is reversed because perfection of surgical technique has made radical methods safer. "Taxis" is undoubtedly practiced by mothers more frequently than we realize, usually with no trouble, and is probably relatively safe in the early hours. The danger lies in the older strangulations when a non-viable loop of bowel may be reduced, or when bowel or some other viscus may be damaged, or perforated. This damage, unfortunately, does not manifest itself until too late. The strangulated loop has been known to be reduced with the constricting neck of the sac so that externally there is no evidence of herniation, whereas in reality the strangulation has not been relieved.

General anesthesia in itself, without manipulation, may sufficiently relax the ring to permit reduction. This was true in one of our cases. However, once the child is anesthetized, one may do a radical cure so rapidly that we preferred to follow this course.

Radical cure of incarcerated hernia is not difficult except in badly neglected cases. Preoperative preparation is a very important part of the procedure. Much can be accomplished in a relatively short time by active teamwork on the part of the surgeon and his assistants. In the treatment of shock, external heat is important as heat loss of marked degree occurs rapidly in infants and must be combated early, as well as during and after, the operative procedure.

We have found that 5 per cent glucose in a physiologic saline solution is valuable in restoring fluid and chloride balance, and in treating the existing acidosis. Seventy-five to 100 c.c. of this solution is injected into the subcutaneous tissues of the thighs or the small of the back, and is usually absorbed rapidly. We prefer not to use the chest wall or axilla because of possible interference with respiration and with anscultation postoperatively. If necessary, fluids may be introduced into the ankle veins, according to the Spivek method.[13] In some patients a transfusion of 75 to 100 c.c. of blood is a valuable adjunct in treating shock. Whole blood, given intramuscularly, may also help.

Gastric aspiration and lavage through a small catheter is almost imperative to prevent aspiration of stomach contents during anesthesia. The procedure is very simple and consumes practically no time.

Anesthesia may be either general or local. Ether by drop method has been used in most of our cases and by the majority of other authors. We have had no untoward experience with it and probably acts as a mild stimulant when used in the small quantities required. In one infant in this series local infiltration of a few c.c. of ½ per cent procaine was used because the

infant was so moribund and the respirations so shallow, that ether could not be administered.

After ordinary skin preparation, the usual incision parallel to and just above Ponpart's ligament is made through the skin and subcutaneous tissues, and the external oblique aponeurosis is divided along its fibers upward from the external ring for a distance of about 3 cm. At this stage the sac can usually be recognized, and should be isolated well up to the internal ring by very gentle blunt dissection. Rarely, a few adhesions must be cut. Care must be used to prevent injury to the delicate vas and spermatic vessels. The time of opening the sac is not important; in our experience, its opening has been inadvertent more often than not. If necessary, the constricting neck may be divided and the sac contents carefully examined before reduction to determine the viability of the viscus. Heat and moisture will usually produce a rapid return of circulation; fortunately, this occurred in every one of our group. If not, one has two alternatives, resection and anastomosis, or resection and production of a fecal fistula as a life saving measure. It is remarkable how much surgery some of these infants can tolerate. Herzfield reported 2 recoveries following resection of the bowel, as have other authors.

After the return of the viscus, high ligation of the sac and suturing of the ligated stump well under the conjoined tendon (Kocher) constitutes the most important step in the radical cure.

The further repair is not all important. Several authors have used one suture between Poupart's ligament and the conjoined tendon, and one in the external oblique aponeurosis with good results. We believe that a Bassini repair gives a very adequate abdominal wall. Cord transplantation is not necessary and with the possibility of trauma through childhood, it is probably better to have the cord protected by more than one layer of tissue. We have used plain catgut sutures throughout the procedure with no untoward results and do not feel that any more lasting suture material is necessary, though chromic catgut has been frequently used by many surgeons.

As a dressing we have found a strip of gutta percha sealed with collodion to be ideal. It requires little or no care, in contradistinction to gauze, antiseptic powders, and other types of protection advocated.

Postoperative care is very important. Any shock must be strenuously treated. These infants have been returned to the incubators and to excellent nursing care of the premature station. Here we follow the outlined routine which is taken from the standing orders for pyloric stenosis that have been in use at Sarah Morris Hospital for some years.

Routine postoperative care

1. Place infant in *warm* crib and see that it is protected from draughts.
2. Elevate infant's head.
3. Place piece of gauze under chin.
4. Give normal saline solution ounces 1, per rectum, immediately upon return from operating room and repeat every three hours.
5. *First Day.* Three hours after return from operating room give breast milk drams 1 every hour. Increase drams 1 every two hours until ounce 1 is reached at the end of twelve hours. Give water drams ½ every hour, increasing drams ½ every two hours.

   Example:

   9:00 A.M. Returned from operating room. Normal saline ounces 1 per rectum.
   12:00 noon Breast milk drams 1. Normal saline ounces 1 per rectum.
   12:30 P.M. Water drams ½.
   1:00 P.M. Breast milk drams 1. Normal saline ounces 1 per rectum.
   1:30 P.M. Water drams ½.

2:00 P.M. Breast milk drams 2.
2:30 P.M. Water drams ½.
3:00 P.M. Breast milk drams 3. Normal saline ounces 1 per rectum.

and so on until after twenty-four hours feedings of 1 ounce of breast milk are given every hour.

Second Day. Breast milk ounces 1 × 12. Water × 6.

Third Day. Breast milk ounces 1½ × 12. Water in small amounts between feedings.

Fourth Day. Breast milk ounces 2 × 10. Water in small amounts between feedings.

Fifth Day. Breast milk ounces 3 × 8. Water in small amounts between feedings.

Fluid intake is supplemented by subcutaneous physiological saline solution, usually with 5 per cent glucose added. Of course, if vomiting begins and persists, fluids by mouth are stopped, gastric lavage is done and after a few hours free from vomiting the routine is restarted.

Ten to 20 c.c. of whole blood is given intramuscularly, or a transfusion of 75 c.c. of blood is given if there is any indication of persistent shock. Usually, however, within a few hours the infants are in surprisingly good condition.

Any untoward complications are treated similarly to those in adults. The surprising fact in our experience has been the smooth postoperative course of the majority of these infants.

To date, there have been no signs of recurrence of herniation in any of the 5 infants that survived.

CONCLUSIONS

Six instances of strangulation are reported occurring in 44 hernias found in 38 premature infants of a total of 830 infants examined, an incidence of 13.6 per cent. In our experience this complication is more frequent than formerly reported.

Increase in intra-abdominal pressure is an important cause of strangulation. Phimosis is more important among these than is generally believed and should be relieved, if possible, as prophylaxis against complications in all infants with inguinal hernias.

Inasmuch as we had only one death in 6 cases, we conclude that treatment of strangulated hernia should be a radical surgical cure if gentle manipulations fails to reduce the strangulated viscus.

I am indebted to Drs. S. Strauss, B. Portis and N. N. Crohn for permission to include their cases in this report.

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BIOPSY IN PROCTOLOGY*

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ALTHOUGH biopsy may not be necessary to establish the diagnosis in the majority of anorectal neoplasms, it is indispensable in certain doubtful cases. In a large advanced cancer service, we observe that errors in diagnosis are of sufficient frequency to warrant emphasizing the value of early biopsy and the careful sigmoidoscopic examination incidental to it.

It is a deplorable but noteworthy fact, that the early and operable malignant or premalignant tumor of the rectum or sigmoid is seldom observed or palpated by the general practitioner. No doubt, the reason for this lies largely with the patient, but the situation will never be much improved until a satisfactory digital and proctoscopic examination are more generally advised and properly performed; with biopsy when indicated.

Electrosurgical methods offer certain advantages in the technique for biopsy. These we desire to emphasize and to describe a new suction electrode handle which we have found very useful in proctologic technique.

There are several minor details in the examination and in the performance of a biopsy which bear emphasis. Cleansing the bowel by adequate catharsis or enema is desirable, particularly in sigmoidal tumors. A suction apparatus facilitates the procedure and it is our practice to use either 20 per cent peroxide or magnesium sulphate as a cleansing vehicle.

The position of the patient depends largely on the habit of the operator. We prefer the inverted or Hanes position, except in cases where the tumor occupies a sharp sacral curve, in which patients the knee-shoulder position is preferable.

The diathermy apparatus should be properly set and the supplementary equipment connected carefully and arranged accessibly before the patient is placed in the desired position (Fig. 2). Several excellent machines delivering the necessary electrosurgical currents are now available. The operator should be thoroughly familiar with his own machine. We have used the Westinghouse Model F Endotherm with entire satisfaction. The usual control setting for biopsy and electric snare techniques is, cutting strength on and at 6, cutting intensity at R; spark gaps open fairly wide but evenly. The current, of course, is biterminal. The dispersive or indifferent electrode should fit snugly. A footswitch must be in the circuit and operated only by the operator. The settings and controls should be checked at regular intervals. Specially instructed nurses are very desirable. Synnott has described the essential armamentarium for conducting a modern proctologic clinic.

A careful gentle digital examination of the rectum should be done to eliminate adjacent complicating pathology or metastases and to determine by palpation, if possible, a favorable site for the biopsy. Pulsating vessels should be avoided. The majority of tumors present bosselated areas from which a loop of tissue is readily resectable. Those near the centre of the malignant ulceration, when present, are more apt to show the true activity and histology of the growth and are better for grading. It should be appreciated in this regard, that negative laboratory reports

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are sometimes not conclusive and may even be misleading.

Those tumors which are covered by apparently normal mucous membrane often present a difficult problem and biopsy may be contra-indicated. Such tumefactions may be extensions from neoplasms in adjacent organs, enlarged mesenteric or rectal nodes of inflammatory, tuberculous or granulomatous nature. Benign tumors of the adnexa may be confusing. The question arises whether it is advisable to cut through the mucosa with hazard of subsequent infection or bowel penetration with peritonitis. To biopsy or not must be decided on the merits of the particular case and its value in comparison with the risks involved. Usually the routine laboratory tests will clear the diagnosis. In this regard, the incidence of error in diagnosis between amebic granuloma, lymhopathia venerea and the specific granulomas of tuberculosis and lues with cancer should be noted.

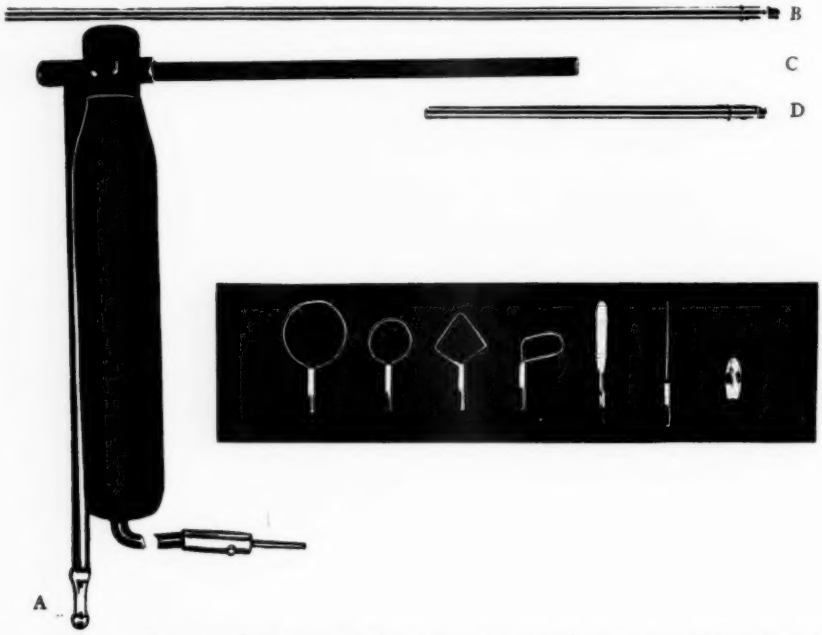

FIG. 1. The author's suction electrode handle. *A*. Suction tube attached to usual tonsil suction apparatus. A variety of electrode tips may be adjusted to any length and any angle, by turning the extension tubes *a* and *b*, in the main shaft *c*.

ANAL BIOPSY

When biopsies are to be taken from anal tumors, it is frequently necessary to anesthetize the spincters. Relaxation of the anal musculature facilitates the digital examination to a degree not yet fully appreciated by the proctologist or general practitioner. A simple perianal injection of 1 per cent novocaine or anucaine which promotes active dilitation and relaxation, will also greatly assist the subsequent instrumental examination.

By gentle eversion of the mucocutaneous junction or skin with Pennington clamps, the tumor is usually readily accessible and exposed. The tissue desired for examination is removed with the cutting loop using a rapid cutting current, particularly when only very small pieces of tissue can be secured.

When the anal canal is constricted, it should never be dilated actively. If good exposure can not be secured by gentle retraction, an anoscope of the proper size should be insinuated into the lumen and the biopsy obtained with a small cutting loop as described. Biopsies from anal and perianal tumors usually offer no technical difficulties. It should, however, be emphasized here, that chronic hypertrophies, particularly on the edges of long standing

fissures, openings of chronic fistulas, particularly of the submucous variety, and skin or scar tissue hypertrophies should be more generally biopsied. Surprising reports may follow.

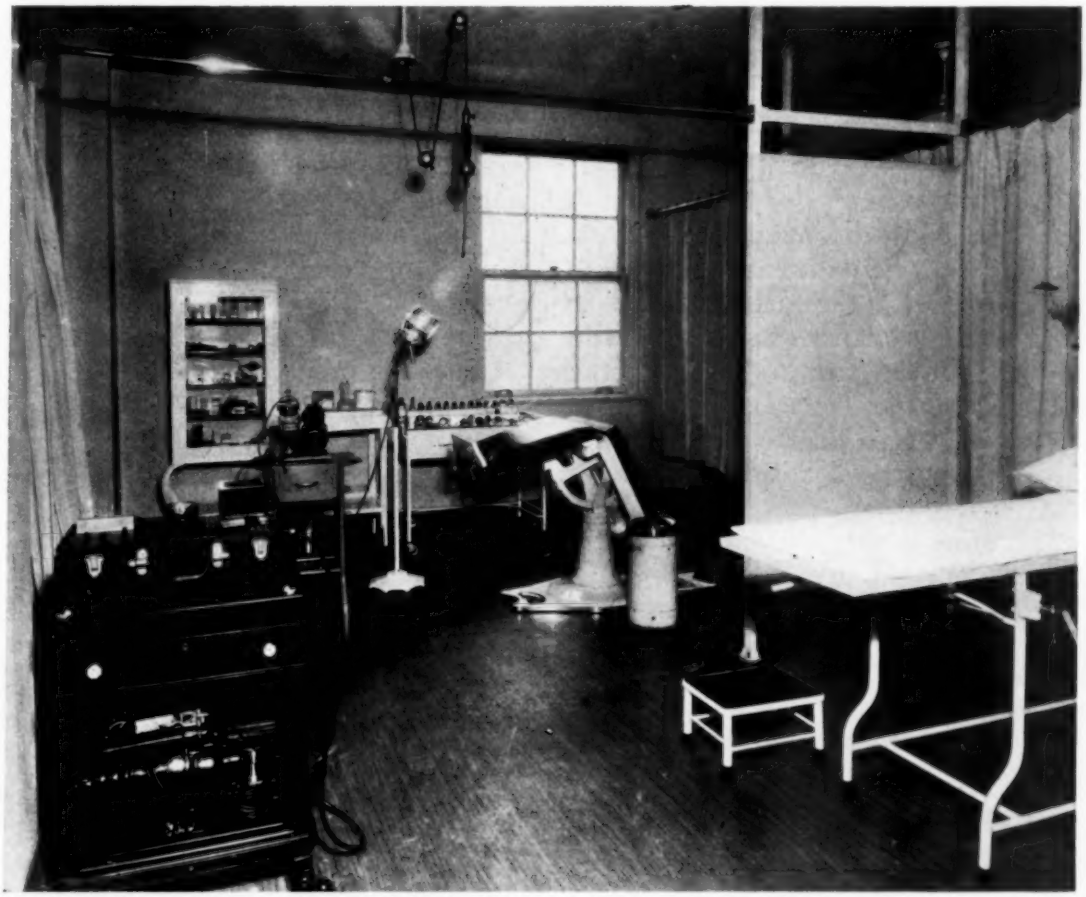

Fig. 2. The Midtown Hospital Proctologic Department. A modern and completely equipped proctologic clinic. Note the suction apparatus, the arrangement of lights, the electrosurgical unit, the Hanes table, the accessibility of all the equipment.

RECTAL BIOPSY

For biopsies from tumors of the rectum proper, the anal canal not being involved, the author prefers a large electric lighted modified Kelly anoscope. Under anal anesthesia as described, it is often possible to see the entire rectum through this scope, which incidentally does not touch or traumatize the tumor. In stout individuals with long anal canals, the longer metal or Bakelite proctoscope may be used to better advantage.

Having cleared the field and selected the site for the biopsy, the author's suction electrode, (Fig. 1) is introduced with the desired sized loop which is slightly engaged into the tumor before turning on the current. This is important since it avoids sparking and sticking of the electrode in the tissues, which should be cut through with gentle lateral and downward pressure. If the proper current setting is used, the loop can be drawn through the tumor like a hot knife through butter.

The suction electrode devised by the author is particularly advantageous in that no smoke blurs the field; the shaft of the active electrode is adjustable to any desired length and the electrode tip may be turned to any desired angle, an important feature in securing biopsies from flat sessile tumors.

In biopsy, the coagulating current, of course, should not be used for cutting since the coagulated area in the base of the

specimen as the loop is drawn through it will destroy the most important part of the tissue and vitiate the proper histological examination. The coagulating current, however, may well be used on the site of the removal to seal any blood vessels and possibly prevent the spread of malignant tissue by implant or traumatic extension. Punched out areas made with the usual cold biopsy forceps may also be advantageously coagulated in this manner.

In those cases where the entire tumor has been removed with the electric snare, it may also be advisable to coagulate the site of removal, bringing it flush with the surrounding mucous membrane, and in selected cases, we frequently circumvallate the site of removal with the coagulating current.

It is at times a very difficult matter to determine the exact depth of the current penetration and it is most important that the operator know his machine and the depth of tissue destruction with the various settings, particularly, when using the electric snare. We have seen bowel penetration with peritonitis following its use in inexperienced hands. Magnifying lenses in our hands have sometimes been of assistance.

It may be noted in passing that biopsy specimens may be readily taken from distal or proximal colostomy loops, by the same technique. The author has suggested the term of abdominal coloscopy for examination of these loops with the sigmoidoscope.

SIGMOIDAL BIOPSY

The removal of biopsy specimens from the sigmoid is done with essentially the same technique as described for the rectum. However, a longer proctoscope or sigmoidoscope is frequently required and the necessity of negotiating a sharp rectosigmoidal angle possibly with adhesions makes the procedure much more difficult than sometimes anticipated. In fact, one finds it necessary to use a small calibre sigmoidoscope through which the convential biopsy forceps will scarcely pass. In these cases, the long suction electrode handle is of particular value, using a small loop.

In very exceptional cases, it may be necessary to secure a biopsy above a stricture which will only permit the passage of a ½ inch scope and through which scarcely any biopsy instrument can be passed. In these cases, we have found the long flexible bronchoscopic biopsy forceps indispensable. This instrument is likewise very useful in securing specimens through the author's extension sigmoidoscope which can be passed 15 inches from the anus.

Under certain conditions, particularly where tumors are definitely above the peritoneal reflections, their removal by the abdominal route with opening of the bowel and followed by resection or anastomosis may prove the less hazardous and the preferable method of approach. It at least envisages the entire pathology and removes all doubt concerning metastases and glandular extensions. Such cases require carefully considered surgical judgment tempered by wide experience.

SUMMARY

A plea for earlier digital and proctoscopic examination of the rectum is made and in doubtful cases biopsy should not be neglected. The author emphasizes the important details and the advantages of electrosurgical methods in securing biopsies from the anus, rectum and sigmoid.

A new combination suction and coagulation electrode handle which the author has found useful in proctologic work is described.

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TREATMENT OF ACUTE PANCREATIC NECROSIS*

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ACUTE pancreatic necrosis or acute hemorrhagic pancreatitis is of peculiar interest to the surgical profession because of its spectacular onset, high mortality and strange, uncertain etiology. Many cases have been reported and excellent experimental work has been done, producing a better understanding of the disease. Nevertheless, the mortality is still very high.

The approved method of treatment at present and for the past thirty odd years, is surgical drainage of the pancreas and the biliary system as soon after diagnosis as possible. This has been advocated even in the presence of serious shock. Operated cases make up the bulk of our statistics, and the cases not operated have been those which have been either overlooked or too sick for any surgical treatment. However, the ability of these patients to recover spontaneously is shown by the fact that many cases reach the surgeon only after they have promptly and safely passed through the acute stage of the disease. It is also shown by the discovery of pancreatic abscesses and cysts, which are definitely late sequelae of pancreatitis, and by the reports of the recovery of operated cases, in which the surgical measures employed could have been of little or no use. Most cases of acute pancreatic necrosis will require prompt surgical help, but is the wide exposure, incision and tamponade of the pancreas, with drainage of the biliary system during the early period of profound shock, a wise procedure? Does the chance of recovery depend upon very early operative interference or upon the extent of the primary necrosis and the physical ability of the patient to withstand the shock of the disease? The mild cases may not be injured by the operation but will the severe cases die because of added shock? Will not a delay of several days, or even a week or two during the acute pancreatic phase of the disease, allow the patient to recover from his shock and result in lower mortality? The answer to these questions must come from the study of large numbers of personally observed cases rather than of a large series collected from the literature or hospital records. Nearly all of the writers upon this subject during the last two years still favor immediate operation although fewer of them advocate operation during shock and some are delaying the operation in the milder cases. Others are convinced of the uselessness of early pancreatic drainage but feel that early biliary drainage is of value. However, more surgeons who have had large experience with this operation and who have studied cases at postmortem are realizing the uselessness if not the actual folly of the early operation.

The following men believe in conservative treatment of this disease or differ in some essential respect from the generally accepted view.

Archibald,[1] while advocating early operation, especially with biliary drainage, states it is his conviction that the mortality depends "upon the type and degree of necrosis" and that "it is difficult to see how the dose of poison derived from the killed tissue can be seriously reduced by operation."

* From the Surgical Division of Toledo Hospital, Toledo, Ohio. Read at the forty-eighth annual meeting of the American Association of Obstetricians. Gynecologists and Abdominal Surgeons held at Skytop, Pa., September 16–18, 1935.

DeTakats and Mackenzie[2] advocate expectant treatment if a positive diagnosis can be made and advise against operation in the initial shock of the disease.

Cooke and Whipple,[3] working with acute pancreatic necrosis in dogs say, "There is a very narrow margin between a non-fatal dose which permits recovery, with but little reaction, and the fatal dose which shows profound intoxication and a rapidly fatal outcome. . . . The gland can repair itself in a remarkable manner if left alone in a closed peritoneal cavity."

Eliason and North,[4] after a study of their cases, conclude "the accepted mode of treatment by emergency laparotomy may not be the best one. Our experience favors dealing with these cases as one would with an uncomplicated acute cholecystitis or an acute salpingitis; namely, deferring the operation until after the acute phase, unless an occasion arises demanding immediate surgical interference."

In 1929, Nordmann[5] reports the recovery of 7 of 9 cases treated conservatively and says that these cases "have awakened in him the thought whether it would not be better, in general, to subject to revision the indications for surgical intervention in acute pancreatitis." He also says that in the "early stage only those cases should be subject to operation which, according to all clinical experience, are capable of withstanding the opening of the free abdominal cavity."

Mikkelsen[10] contends that drainage by incision of the pancreas, is anatomically impracticable and may increase the danger of necrosis, of serious hemorrhage or pancreatic fistula. Bile duct drainage he considers more logical but does not feel it has lowered the mortality of the disease chiefly because the patients are too ill for operation. He favors conservative treatment and operates only in cases in which gallstones or gall duct pathology is present and then only from one to three weeks after the subsidence of the acute symptoms of the pancreatic necrosis. In the last eight years he has so treated 39 cases with severe acute disease of the pancreas, 20 of which were extremely ill. His total mortality was 7½ per cent.

At the Mayo Clinic[33] they do not operate upon acute pancreatic necrosis during the stage of shock but if possible prefer to wait until the patient has improved and careful studies can be made of the gall bladder and the gastrointestinal tract.

Parry and Murry,[31] Peterson[27] and Ehrmann[32] are also among those who advocate conservative treatment.

The pancreas lies behind the stomach under the peritoneal floor of the lesser cavity. The greater part of the head of the gland lies between the layers of the mesentery of the transverse colon. The pancreas has no real capsule, either macroscopically or microscopically. The peritoneal covering and a very small amount of fibrous connective tissue continuous with the delicate stroma of the organ, alone separate the anterior surface of the gland from the peritoneal cavity. Therefore, fluid escaping from a necrotic pancreas easily enters the lesser cavity while much of it is distributed in the loose retroperitoneal tissues near the pancreas and in the mesentery of the transverse colon.

Behind the pancreas is a dense network of lymphatic vessels, nerve fibers and the ganglia of the solar plexus. Above it lies the celiac axis, with the large splenic vessels running the whole length of the organ. At the right, around the head of the gland, are the gastroduodenal and pancreatoduodenal vessels. At the lower edge of the neck, the superior mesenteric vessels emerge. Under the pancreas, and in intimate relation with it, are the portal vein, the inferior vena cava, the aorta and the left renal vessels. It is probable that in pancreatitis, the sudden escape of a necrosing fluid among these vital structures is an important cause of the profound shock which follows. Maconie[12] reports the case of a healthy man of twenty-nine years, who was suddenly seized with severe epigastric pain and died in a few minutes. Autopsy revealed a hemorrhage throughout

the whole pancreas as the only cause of death. A number of such cases are reported in the literature. It is evident that it is hazardous to attempt to institute drainage by burrowing among these vessels with an instrument or with the finger, especially when they have been softened by the necrosing effect of escaping pancreatic ferments. Most surgeons do not advocate such a procedure and it is doubtful whether those who do, really open the retroperitoneal tissues sufficiently to establish adequate, immediate drainage which can either remove or prevent the spread of the toxic fluid which is the probable cause of shock and prostration. In fact, it is questionable whether adequate, immediate drainage can be efficiently established. There is no doubt that drainage can be instituted, which will remove the fluids that will be escaping for days and weeks thereafter, and which arise from gradually disintegrating blood clots, dead pancreatic tissue, necrotic fat and from pancreatic secretions escaping from sloughing ducts.

Walzel,[11] after warning against incision of the pancreas, because of his experience with a fatal hemorrhage from the splenic vein, makes the statement: "Genuine pancreatic necrosis is a purely chemicobiologic process which cannot be arrested by a relief incision, as would a bacterial necrotic focus, for instance a carbuncle."

The anatomical possibility of establishing efficient drainage of the pancreas or to the retroperitoneal tissues in the early hours of acute pancreatic necrosis, is one of the principles upon which rests the present method of surgical treatment. From Archibald's[1] animal experiments, we know that necrosis of the pancreas takes place in a very short time, and from clinical experience we know that retroperitoneal infiltration and fat necrosis are well established at the earliest operation. It therefore seems improbable that an operation can be done in time to anatomically limit the process, either in the pancreas or in the retroperitoneal tissue. Moreover, the peritoneum over the pancreas is very thin and offers little or no resistance to escaping fluid. The pancreas itself has no capsule but is made up of many very small lobules each of which is surrounded by a delicate stroma of connective tissue which does not interfere with the escape of secretions. An incision into the pancreas will not drain the whole organ but only the lobules it happens to open. In order to drain the entire pancreas surgically and relieve any possible tension within it, it would be necessary to incise each lobule, a procedure manifestly impossible and certain to add to the local necrosis rather than relieve it. The only efficient retaining wall against escaping fluid is that formed by adhesions and necrotic tissue and this is only effective later in the disease. Furthermore, much of the toxic material remains fixed in coagulated fibrin, fat and necrotic pancreas and cannot escape quickly even if the tissues are opened widely. It, therefore, does not seem logical to make an incision into the pancreas or into the tissues around it to aid in drainage. Finally, as the fluid found free in the peritoneal cavity in the early hours of this disease has been proven to be harmless, it would certainly seem that early drainage of the pancreas or the abdominal cavity is not logical in the light of anatomical or pathological facts. It will be said, however, that clinical cases recover promptly after surgical drainage but it can also be asserted just as positively that they often recover with equal promptness when not operated.

The etiology of pancreatic necrosis forms a strange and incomplete chapter in human pathology. For some cause, a part of the pancreas becomes necrotic, and in the process of degeneration of the dead tissue, certain poisons are elaborated, which when absorbed, are probably responsible for the clinical picture of the disease. Experimentally, death of pancreatic tissue has been produced by the injection of many different fluids into the pancreatic duct. They all have a common ability to cause necrosis, but the most important of these

necrosing fluids is the bile. Clinically, the disease has followed pathology in the gall bladder and liver ducts, obstruction of the pancreatic duct, acute systemic infection, local septic foci about the pancreas, trauma, the interruption of blood supply with infarction in the pancreas and, curiously enough, the presence of a round worm in the pancreatic duct. Whether the necrosis results directly from the immediate destructive action of bile or some other factor, or is due to the autodigestion of the pancreatic tissue by trypsin, is unsettled. Recently, the ability of trypsin to digest living tissue has been questioned.[6] The exact chemical nature of the toxin which causes this disease, and the method of its formation have not been determined. According to Petersen, Jobling and Eggstein,[8] death is usually due to the sudden flooding of the blood stream with the higher split proteins formed at the expense of the necrotic pancreatic tissue. Trypsin has been suggested as the actual poison, or as the cause of the autolysis which produces the toxic split proteins. Histamine has also been mentioned as the possible toxin. Recently, Dragstedt[6] has suggested that the toxic substance is due to bacterial action in the dead glandular tissue. He found bacteria present in the pancreatic tissue of all his experimental animals and, in the majority, it was Bacillus Welchii. Of course, the discovery of a specific toxin producing the symptoms of pancreatic necrosis would be very desirable as it might lead to some means of neutralizing its effect at the critical stage of the disease. Guleke[30] reports the use of heparin as valuable in neutralizing the "trypsin poisoning" which he holds is the cause of intoxication early in this disease.

It has been proven beyond a doubt that bile injected into the pancreatic duct will cause typical pancreatic necrosis, and that obstruction of the lower end of the common duct, as by a stone, stricture, inflammatory swelling or a spasm of the sphincter of Oddi, can form a continuous channel and make the flow of bile from the liver and gall bladder into the pancreas, through the duct of Wirsung, anatomically possible. It has therefore been suggested that decompression of the gall bladder or common duct, at the time of operation for acute pancreatic necrosis, might stop the flow of bile into the pancreas and prevent further necrosis. However convincing this bile theory of pancreatitis may be, it is by no means proved that this disease is usually caused by the reflux of bile into the pancreas, although the consensus of opinion at present, places it in the leading role. However, Mann and Giordano,[7] after most careful and extensive work, contend that this is only a rare possibility and that we must look elsewhere for the explanation of the cause of most cases of pancreatic necrosis. Nordmann[5] found, that in spite of drainage of both the common duct and the pancreas, a considerable number of cases which showed limited pathology at operation, developed a total pancreatic necrosis by the time they came to autopsy. Granting that the bile factor is of importance in the etiology of pancreatic necrosis, it has not been proved that bile is forced into the pancreas continuously over a considerable time so as to justify drainage of the biliary system as an emergency operation. However, biliary drainage is an important surgical principle in this disease and it should be employed in case there is pathology in the gall bladder or liver ducts in the hope of preventing further attacks of necrosis.

Less convincing, perhaps, is the theory that pancreatic necrosis is initiated by the extension of infection from the diseased liver or gall bladder, by following the lymphatic channels along the cystic and common ducts to the head of the pancreas, or by an ascending infection through the common and pancreatic ducts. Experimentally, the disease has never been so produced. However, the majority of cases of pancreatic necrosis have had a previous history and often a very recent history of

gall-bladder infection, or have shown stones or evidence of cholecystitis or cholangitis at operation or postmortem. From personal experience, also, one is forced to conclude that infection in the liver and its ducts is in some way an important etiological factor, and that the thorough correction of all pathology in the biliary system, as a prevention of future attacks of pancreatic disease, cannot be too strongly emphasized. In this connection Nordmann[5] makes the statement: "At first the concurrence of diseases of the gall bladder and of the pancreas was regarded as coincidental. Gradually, the conclusion has been reached that the two organs are diseased simultaneously much more frequently than had been assumed originally."

The pathology of pancreatic necrosis is well known. Sudden edema of the whole or a part of the organ is quickly followed by hemorrhage and necrosis, and at times, by infection. Pancreatic ferments and toxic substances escape into the blood stream, retroperitoneal tissues and into the peritoneal cavity causing tissue necrosis and a chemical peritonitis. The peritoneal cavity is flooded with a brownish or bloody fluid and the fat of the upper abdomen contains whitish areas of fat necrosis. Later, pancreatic abscesses, cysts, or peritonitis may develop.

The ferments which escape in the early hours of this disease are relatively small in amount and derived only from dead pancreatic tissue and not from the living, secreting gland that is left. This is probably due to the immediate inhibition of gland function by the shock of the pathological process. This is mentioned here because the massiveness of the early pathology and free drainage of pancreatic juice, with skin irritation during convalescence, has created a popular opinion that the free escape of pancreatic secretions plays the important part at the onset of this disease. However, the present belief is, that aside from the neurogenic shock due to the destruction of pancreatic tissue and the surrounding structures, split proteins, the result of autolysis or bacterial action, are the cause of the serious symptoms of the disease, and not the pancreatic ferments. It is of interest in this connection that Senn,[9] years ago, severed the main pancreatic ducts in animals, allowing the pancreatic juice to escape freely into the peritoneal cavity. There was no necrosis nor were there serious or fatal symptoms. This work has been recently verified by Dragstedt,[6] who found that even when such secretions were known to be activated they caused no trouble, if free from bacterial infection. That the cause of the symptoms lies in the dead and not in the living tissue, is shown by the well known experiment of removing a piece of pancreatic tissue under aseptic precaution from one dog and placing it in the peritoneal cavity of another. Death takes place rapidly with the symptoms of pancreatic necrosis. Dragstedt[6] recently claims to have proved that this piece of tissue is harmless, if freed from all bacteria before being placed in the peritoneal cavity. He says that these bacteria are present in the ducts of the pancreatic tissue when removed from the animal and that they are derived from the intestinal canal. If these things are true, it is hard to understand how any operation, short of the actual removal of the dead gland tissue, can stop the formation of the poison, or how drainage, no matter how extensive, can quickly remove more than a small part of the toxic substance.

The characteristic brownish peritoneal fluid, so universally found in the early stage of this condition, is caused by the irritation of toxic substances from the dead pancreatic tissue. These toxic substances are so diluted and neutralized by blood and peritoneal exudate that they are no longer harmful and need not be removed. When the abdomen is opened a week after an acute attack this fluid has usually disappeared.

Fat necrosis is a finding peculiarly diagnostic of pancreatic disease and results from the escape into the tissues and into the peritoneal cavity of the fat splitting

ferment, lipase. The ferment is widely distributed by the lymphatic channels and in the blood stream and does not seem to be toxic. The fat necrosis appears to be more extensive in the severe cases. However, very large areas are not incompatible with the prompt recovery of the patient. The greater part of the mass palpable in this disease is necrotic fat and forms the bulk of the whitish, granular or lumpy postoperative discharge. The large pieces of sloughing tissue discharged after operation and supposed to be pancreas are usually only necrotic fat. It is important for the operating surgeon to decide when to drain areas of fat necrosis. The smaller scattered areas will absorb but the larger ones will break down and form a collection of grey fluid which must be drained. However, in Case XI of this series, operated in December, 1934, such an area about 3 inches in diameter was not drained after removing the gall bladder and a stone from the common duct. The patient has remained well and no abscess or cyst has developed. Besides an increase in size, the indications for draining such a mass are fever, a high white blood count and especially, persistent vomiting with rapid loss of weight. Case VII in this series lost ninety pounds in the three months before it was drained.

The amount of infection present in the pancreas at the onset of acute pancreatic necrosis is relatively so small that signs of suppuration rarely appear in the necrotic pancreas, the extensive areas of fat necrosis, the infiltrated, retroperitoneal tissues, or in the exudate in the peritoneal cavity. When suppuration does develop it is more often late, is localized and can be managed satisfactorily. Early peritonitis with a retroperitoneal cellulitis is a very serious complication and is not easily influenced by surgical measures. The fact that it does occur in a certain percentage of cases is an argument for early operative treatment.

A reason frequently given for immediate operation in acute pancreatic necrosis is that the diagnosis is difficult and that some obstructive or perforating lesion of the gastrointestinal tract may be overlooked. However, such lesions can usually be recognized by means at our disposal, while cholecystitis, the acute lesion most often confused with pancreatitis, can nearly always be treated conservatively. In this connection I would emphasize, that if one will only keep pancreatic necrosis in mind, it will not often be missed.

Acute pancreatic necrosis has been confused with most of the more serious acute surgical conditions of the upper abdomen. The severe pain and shock typical of this disease give the first warning of the nature of the trouble. The onset of the pain is instantaneous and frequently radiates to the shoulder. Marked cyanosis is a sign of severe intoxication. I have seen it only twice and both patients died. Unlike cases with ruptured peptic ulcer, these patients are restless. Persistent, intractable vomiting is a very constant and important symptom. It is watery, with gastric or duodenal contents and is never foul or fecal. The abdominal tenderness and muscle spasm are slight in comparison with the patient's agonizing pain. This is due to the deep, protected position of the pancreas. The tenderness present in the early hours of this disease is definitely over the anatomical location of the pancreas. In cholecystitis the tenderness has its center in the gall-bladder region and is much more acute, owing to the more superficial location of this organ. In ruptured peptic ulcer the generalized tenderness and boardlike muscle spasm develop quickly and are in great contrast to the small amount of rigidity present in acute pancreatic necrosis. Only rarely, too, are acute cholecystitis and ruptured peptic ulcer associated with the severe prostration of this disease. However, many cases of pancreatic necrosis do not exhibit such severe symptoms and are mistaken for other conditions, especially cholecystitis. Under these circumstances, the diagnosis may often be made by the rather acute tenderness of pancreatitis definitely

outlining the position of the pancreas. The generalized tenderness due to the escape of irritating substance from the pancreas is less marked and not so sudden in onset as in ruptured ulcer.

A mass appearing suddenly in the pancreatic region following symptoms typical of pancreatic necrosis, makes the diagnosis practically certain, although it may rarely be confused with ruptured peptic ulcer with abscess. The mass may appear late, may be in the left flank, or, if the patient is fat or distended with gas, may not be palpable at all. The absence of a demonstrable mass is no contraindication to a positive diagnosis, for the area of necrosis may be small, 2 or 3 cm. in diameter, and still cause severe symptoms. The *x*-ray film is of real help in diagnosing tumors of the head and body of the pancreas. In the tumor of pancreatic necrosis, the widening of the duodenal curve and the displacement and distortion of the stomach and colon are very valuable aids. When the tumor is in the left flank, a barium enema and a pyelogram of the left kidney are of help in establishing anatomical relations.

Other less important and less constant findings are mild temporary jaundice, sugar and albumin in the urine, large fatty stools, a high white blood count, over 25,000, and increased residual nitrogen in the blood, and an increase in the hemoglobin and red blood cells from dehydration. DeTakats and Mackenzie[2] say that in the absence of a diffuse peritonitis, a high blood sugar and high diastase content point definitely to pancreatic involvement. Other writers report that the fat splitting ferment, lipase, resulting from tissue necrosis is a valuable diagnostic aid because it is present in the urine longer than diastase. However, the diastase test is the only one that has been used extensively in clinical work. Experimentally it has been found that injuries to the pancreas,[13] ligation of the pancreatic duct[14,15,16,17,18,19,20,21] and of the common bile duct,[16] or artificially produced pancreatic necrosis[24] will result in a great increase of the diastase (amylase) in the blood and urine. As might be expected, in acute pancreatic necrosis and in common duct obstruction by stone in human beings, diastase has also been found greatly increased. However, as it is rapidly eliminated by the kidneys, it is found in increased amounts only during the first thirty-six to forty-eight hours. Although other methods are known,[25,26] the diastase is usually estimated by measuring the ability of this enzyme to effect a given change on a starch solution of a known percentage. The Wohlgemuth test[22] or some modification of it, such as that of Fabricus Moeller,[23] is the most commonly used. The Wohlgemuth test has been found by many workers[16,24,23,27,28,29,30] to be of real clinical value in differentiating acute conditions of the pancreas and gall ducts from other acute abdominal diseases. When there are symptoms fairly typical of pancreatitis and the diastase content of the urine is high, they say that a diagnosis of acute pancreatic disease can be made with certainty. If the ferment is normal in the urine, the trouble is quite surely not in the pancreas or liver ducts. However, it must be remembered that the test is only of value in the first thirty-six to forty-eight hours of the disease, as after this the amount of ferment in the urine quickly falls to normal.

The cases of acute pancreatic necrosis are best classified clinically as fulminating, severe and mild. The variation in the types of cases and the irregular occurrence of such complications as necrotic masses, abscesses and cysts have led to much confusion as to their origin and classification.

The fulminating cases of this disease show all the exaggerated symptoms of sudden agonizing pain, shock, vomiting and cyanosis, typical of the condition. Death usually takes place within a few hours and every form of treatment seems useless. They certainly should not have to suffer the distress of an operation. However, when not operated but treated by general supportive measures a number of

such cases, reported in the literature, have recovered with surprising promptness.

The mild cases of this disease include those of pancreatic edema and those in which only a small amount of the pancreas is destroyed. There is little escape of pancreatic ferments or toxic split proteins and certainly no gross setting free of the pancreatic secretions, for the lesion is often absorbed without operation and, when drained surgically, very little or no pancreatic secretion escapes. In this group the initial pain, shock and vomiting may be severe but the patients recover promptly and within a week may be in excellent condition. Immediate operation upon these cases is harmless but probably cannot stop their progress into the more severe type. Delayed operation is safer and the pathology in the gall bladder and liver ducts can then be thoroughly corrected by cholecystectomy with exploration and drainage of the common duct.

TABLE I

PRIVATE CASES OF AUTHOR	AGE	DEGREE OF PAIN	SHOCK	VOMITING	CYANOSIS	JAUNDICE	GLYCOSURIA	WHITE BLOOD COUNT	FAT NECROSIS	GALL BLADDER SYMPTOMS	GALL BLADDER DISEASE
1. 1–23–23 Mrs. G. L.	43	+++	++	+	0	+	+	10,000	+	+++	Cholecystitis, stones.
2. 12–26–32 Mrs. E. V. H.	45	+++	++	+++	0	+	+	17,500	+	+++	Subacute cholecystitis, stones.
3. 2–20–23 Mrs. M. T.	31	+	0	+	0	+	0	12,000	0	++	Acute infection
4. 11–10–17 Mrs. H. P.	23	+++	++	+++	0	0	0	18,000	++++	++++	Cholecystitis, stones.
5. 7–23–24 Mrs. E. S.	57	+++	+++	++++	0	0	+	13,000	++++	++++	Cholecystitis, stones.
6. 1–30–33 Mr. F. S.	50	+++	++	+++	0	+	0	15,000	++++	++++	Empyema, stones, rupture, abscess.
7. 10–12–28 Mrs. H. S.	23	+	0	++++	0	0	0	14,000	0	+++	Cholecystitis, stones.
8. 10–10–28 Mrs. M. C.	35	+++	++	++	0	0	0	15,800	+++	+++	Cholecystitis, stones.
9. 4–29–27 Mr. S. O. R.	65	++++	++++	+++	++	0	0	16,000	++	+	Cholecystitis.
10. 10–25–21 Mrs. M. S.	40	++++	++++	++	++	0	0	33,000	++	0	Not explored
11. 12–13–34 Mr. P. K.	54	++++	++	+++	0	0	0	18,500	++	+++	Cholecystitis, stones in gall bladder and common duct
12. 1–11–35 Mrs. M. W.	36	+++	+++	+++	0	0	+ Diabetes	20,200	+++	0	Slight cholecystitis.

The intermediate group of severe cases is the largest. The clinical symptoms are very alarming and the mortality high, but these patients have a tendency to react and the majority of them recover. Other things being equal, the question of life or death is probably determined very early

in the disease by the amount of the pancreas involved and by the physical ability of the patient to withstand shock. Many in this group will require surgical drainage of the necrotic pancreas and most of them correction of the pathology in the biliary system. They die of shock, infection or from inanition from persistent vomiting, or go on to abscess or cyst formation. For years this group has been treated by immediate operation in the earliest possible stage of the disease. It is here contended that this method does not limit the extent of the disease nor does it, by drainage, relieve the early, primary shock sufficiently to justify the risk of the operation. It is believed that morphine, ample fluids with saline and glucose and other supportive measures will give a better chance of recovery from the immediate precarious condition.

TABLE I

PANCREATIC PATHOLOGY	COMPLICATIONS	PANCREATIC DRAINAGE	BROWN PERITONEAL FLUID	RESULT	TIME OPERATION	OPERATION	MAXIMUM TEMP.
Moderate necrosis.	Continued attacks of pain postoperatively.	None.	None.	Well 14 years	Deferred 2 weeks	Cholecystectomy, exploration and drainage common duct.	98.6
Moderate necrosis.	None	None	None	Well 2 years	Deferred 6 days	Cholecystectomy, exploration and drainage common duct.	100
Edema, mass.	Temperature 99.5°, acute tonsilitis.	None	None	Well 12 years	Deferred 10 days	Cholecystostomy, drainage pancreas.	99.5
Extensive necrosis, mass.	High fever, infection, hemorrhage	Large amount	Large amount	Well 17 years	Third day	Cholecystostomy, drainage pancreas.	104
Extensive necrosis, mass.	Severe asthenia, infection.	Large amount	None	Died 5 months	Deferred 14 days	Cholecystostomy, drainage pancreas	101
Extensive necrosis, mass.	Acute cholecystitis, rupture & gall bladder.	Very large amount	None	Well 1 year	Deferred 4 weeks	Drainage necrotic pancreatic mass, cholecystostomy.	102
Cyst.	Asthenia, loss of ninety pounds.	Large amount	None	Well 4 years	Deferred 3 months	Drainage pancreatic cyst three months after cholecystectomy.	100
Necrosis, abscess.	Acute cholecystitis.	Large amount	None	Well 4 years	Deferred 14 days	Lumbar drainage pancreatic abscess, cholecystectomy.	104
Moderate necrosis.	Extremely fat.	None	Large amount	Died second day disease	Second day	Drainage pancreas, in shock.	97
Not explored	.....	None	Large amount	Died third day disease	Third day	Drainage abdomen, in shock.	97.4
Extensive necrosis.	Stones in gall bladder and common duct	None	Only turbid fluid	Well nine months	Ninth day	Cholecystectomy and removal stones from common duct and drainage	100.6
Extensive necrosis and hemorrhage	Diabetes, pituitary, discharge	None	Very little	Died third day disease	No operation	None. (Autopsy)	105.5

Granting that the diagnosis of pancreatic necrosis is correct, it must be decided for each individual patient at just what stage of recovery surgical procedures are best instituted. If the patient survives the period of shock, it is surprising how promptly he may recover and how well the walled off necrotic mass is tolerated. If, after several days, the symptoms tend

to increase as the result of the infection, drainage should be established in the simplest possible manner. Even then, operation should be undertaken only when the patient can reasonably withstand the procedure.

When this period of shock has passed the operation may be performed immediately if good surgical judgment so indicates in any individual case. However, within one to three weeks after the onset of acute pancreatic necrosis the cases which have survived and have not required drainage for infection will usually have recovered sufficiently for careful study and necessary surgery. Cases with no pathology in the biliary system, stomach or duodenum, and no large areas of necrosis about the pancreas cannot be helped by abdominal surgery. However, biliary disease or a history of it is so very common in these conditions that only rarely will there be a case which will not need exploration of the gall bladder and liver ducts. When a large mass, with extensive fat necrosis, has formed near the pancreas it will require an operation. However, at the time that this is done a thorough correction of all biliary disease is impossible and even a simple drainage of the gall bladder may be very difficult because of extensive adhesions and fat necrosis. If the area to be drained is small, the biliary pathology may be corrected at the same operation. In many cases, however, no areas of necrosis will need draining and only the biliary pathology will remain to be corrected. This is best accomplished by removing the gall bladder and carefully exploring the common duct for stones or other obstruction. It is my opinion that correction of all pathology in the biliary system is necessary for the prevention of further trouble in the pancreas and that the removal of the gall bladder is needed to accomplish this. In addition all other foci of infection, so far as is possible, should be eliminated, for they may be a real etiological factor.

If the operator feels that he must follow surgical teaching and operate during the early acute stage of this disease or, if he has come upon the condition with a mistaken diagnosis, he should certainly limit his efforts to the simplest adequate drainage of the biliary system and of the lesser peritoneal cavity. Thorough correction of all biliary pathology at this stage is too dangerous and even drainage of the pancreas may prove unsatisfactory so far as later sloughing is concerned.

The clinical experience which forms the basis for this paper was derived from the study of 12 private cases of acute pancreatic necrosis, all proved by operation or autopsy and carefully observed during the whole course of the disease. Among these cases there were four men and eight women, their ages ranging from twenty-three to sixty-five years. The pain was severe in 10, moderate in 2. In 3 cases the shock was ultra severe; in 6 severe; and mild in 3. Vomiting was present in all the cases; cyanosis in 2; jaundice in 4; glycosuria in 4; and fat necrosis in 10. The leucocyte count ranged from 10,000 to 33,000 and the temperature from 97° to 105°F. Gall-bladder symptoms or gall-bladder disease were found in 11 and the information was not obtainable in one. The pathological processes present in the pancreas were edema, hemorrhage, necrosis, cyst and abscess. The complications were hemorrhage, sepsis, asthenia and ruptured gall bladder. Postoperative pancreatic drainage was free in 5 and absent in 7 cases. Brownish peritoneal exudate was present in 4 cases; it was never found at operations deferred for two weeks, and in one case it had disappeared at operation done on the sixth day of the disease. Four cases died and 8 recovered. Two of the 4 who died were operated on the second and third days while in shock. The third case was operated on the fourteenth day and died of asthenia at the end of five months. The fourth, a fulminating case, was not operated at all. The other cases, except one, were deferred from six days to four weeks. All the various surgical procedures, except incision of the pancreas

itself, were used for different stages and conditions of the disease.

CONCLUSIONS

Early operation in acute pancreatic necrosis, during the period of shock, is not justifiable because we have no efficient surgical means of relieving the shock or of removing its cause, and, also, for the reason that the operation adds seriously to the risk already present. All known operative measures such as cholecystostomy, cholecystectomy, drainage of the common duct and of the lesser peritoneal cavity and incision and drainage of the pancreas, have probably not limited the extent of the necrosis or appreciably lowered the mortality in the early stage of the disease. The removal of the fluid from the lesser peritoneal cavity and from the retroperitoneal spaces in the early hours of the disease is accomplished very imperfectly and is not as valuable as usually assumed. In acute pancreatic necrosis, the frequent occurrence of pathology in the gall bladder and liver ducts is no mere coincidence but its correction is of prophylactic, not of curative value. The fatal cases have all shown extensive necrosis of the pancreas and this uncontrollable factor when measured against the physical resistance of the patient is believed to be the deciding cause of death. It is noticeable, however, that many reported cases die very soon after an early operation. The margin of safety between the fatal and non-fatal cases is very narrow at times and it is believed that at the critical period the patient can handle the situation more safely if not embarrassed by the shock of an operation. Most cases of this disease will require surgical help at some stage, but the opportune time can be decided only by experienced surgical judgment. Is it not probable that the real problem of lowering the terrible mortality of acute pancreatic necrosis is more likely to be solved by the biological chemist than by the surgeon?

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[*For Remainder of References see p. 510.*]

CASE REPORTS

IMPORTANCE OF PRICKLE CELL LAYER IN SKIN GRAFTING

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IN 1925 Thuringer, in studying the histology of the skin, noted that the greatest number of mitotic figures were seen in the lowest part of the prickle cell layer. He studied various parts of the body but the mitotic activity of these cells was always constant. Hartwell, independently, while studying the healing of surgical wounds noticed contrary to the accepted teaching that the cells of the prickle cell layer were definitely the most active in wound healing. The role of the basal cell layer was unquestionably secondary.

Appreciating the value of this observation I am reporting a case of pinch graft to the neck in which a definite effort was made not to go beyond the lowest part of the epidermis, feeling that grafts with a base of active mitotic cells should give a higher number of satisfactory takes. In the case to be reported forty-three of forty-eight skin grafts applied to granulatory wound of the neck took successfully.

CASE REPORT

P. S., aged fifty-two years, was admitted to St. Mary's Hospital with a large sloughing carbuncle of the neck, 15 × 8 cm. After trying conservative treatments unsuccessfully the case was operated and the entire carbuncle removed en masse. After six weeks this granulating wound was skin grafted using the mentioned observation in our operative technique.

All laboratory findings were negative except for a grade 1 (I–IV) sugar in the urine, which was easily controlled with a dietary regime. The hemoglobin was 58 per cent, Dare or 8 grams per 100 c.c. of whole blood.

The pinch grafts, under local anesthetic, were removed from the right side of the back under the scapula, at no time going beneath the epidermis. A plain straight needle clasped in a Kocher clamp was gently pushed in the epidermis and the skin elevated, while in this position a sharp razor cut off the elevated tissue. The grafts each averaging in size about 2 to 4 mm. in diameter, were applied to the patient's neck and covered with paraffin mesh gauze held on with strips of adhesive.

In reporting this case I feel that the large number of satisfactory takes might be attributed to confining the section of epidermis taken for the graft to that portion which histologically is the most active in skin regeneration.

SUCCESSFUL OPERATION FOR MESENTERIC VASCULAR OCCLUSION

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IT IS nearly a century since Tiedemann in 1843, first recognized this condition. For several years it was merely a finding at necropsy, but has since assumed a position of great importance in clinical surgery. The term chosen, suggested by Trotter, seems preferable to "mesenteric embolism," "mesenteric thrombosis," "mesenteric arterial embolism," or "mesenteric venous thrombosis."

INCIDENCE

The condition while infrequent, can scarcely be termed very rare: In thirty-three years there were 206,571 surgical admissions to Boston City Hospital, Robey states, and 51 instances of mesenteric vascular occlusion. Sheahan reports 13 among nearly 50,000 surgical cases in 11 years at the Massachusetts General Hospital. Of the 30,000 surgical admissions in a decade at the Lankenau Hospital in Philadelphia, there were but 2 cases, both in veins, according to Ross. At the Baylor Hospital in Dallas, Flynn writes 2 examples were met in 27,712 surgical affections. Warren and Eberhard state 11 of the 26,793 surgical admissions at the Palmer Memorial Hospital, Boston, were for this affection. At the Tübingen surgical clinic only 3 cases occurred Reich reports in ten years; and in the same country Saxer informs us but 6 examples were discovered, one venous rest arterial, in the extensive necropsy service in Leipzig; while there were 9 cases in Ophüls', of Leland Stanford University, series of 3000 necropsies.

Coming now to private practice, Blackburn some years ago sent a questionnaire to 115 surgeons in the territory of the Southern Medical Association, receiving reports of 45 unpublished cases, verified by operation or necropsy. These occurred in 40,000 to 50,000 abdominal cases, about 1:1000.

Recently, since interventions for "acute abdomen" have grown so numerous, this affection is recognized more often. After Watson became interested in the condition at the Boston City Hospital, he found 8 cases in a year, while only 6 had been previously noted in nine years. So too, Loobe operated on 9 instances in three years, and MacCornack 3 cases in eight years. Further evidence as to the uneven occurrence of the condition is found in Councilman's statement that his 3 necropsies were all done in a fortnight, the "first specimens seen for a number of years."

This mesenteric occlusion is found in horses as well, in this animal being due to aneurysms caused by a parasitic worm, Strongylocentrus armatus.

Sex: The proportion given long ago by Jackson, Porter and Quinby was 64 per cent for men, and 36 per cent for women; but of 210 recent cases the difference was not quite so great, 131 men and 79 women.

Age: We find the extremes of life involved, of the 210 cases collected by Jackson, Porter and Quinby, 2 were "90 or over." On the other hand, this lesion has been found in infants of four weeks (McClanahan), 5 weeks (Cokkinis) and 6 weeks (Ingebrigtssen). Three boys, one of 8 and two of ten years seen by Frank were successfully operated on.

It has been learned of late years that the average age is lower than supposed formerly. Thus of 308 subjects, 63 per cent were under fifty years; and in the 76 personal cases cited by Cokkinis, no less

than 76.3 per cent were under fifty years, some 13.3 per cent under twenty years.

Friedman gives the details of cases in two brothers of forty-four and forty-six years, respectively; and curiously, the inferior artery was involved in both.

Race: There are few details of this aspect, though of 61 recent cases in this country, only 8 were in negroes and one in a Chinaman.

ETIOLOGY

In the series of 360 cases collected by Trotter, 53 per cent involved the arteries, 41 per cent the veins and in 6 per cent there was simultaneous obstruction of both arteries and veins.

Occlusion of the superior mesenteric artery is more common than of the inferior, as might be expected from its larger caliber, 8 mm. compared to 3.5–5 mm. for the inferior, according to Henle and Poirier; its origin above the other, and its more direct course, running parallel with the aorta, while the inferior is given off at an angle of about 45°. The cause here in most instances is endocarditis or arteriosclerosis, of 79 cases, 57 were due to endocarditis, 17 to arteriosclerosis, and in the rest no etiologic factor was discovered (Brady, Reich, Robey). In Gordon's patient syphilitic endarteritis was present; and in the two brothers seen by Friedman there was "premature" arteriosclerosis.

Lagane recognizes an "arteriosclerotic syndrome of the intestine" Of which there are two factors, atheroma of the mesenteric arteries and arteriosclerosis of the intestinal arteries. The former are generally associated with chronic lesions of the aorta and the rest of the vascular system, often in syphilitics past fifty years and atheromatous. Arteriosclerosis, on the other hand, occurs in young subjects, alcoholics, with plumbism, former enterics, or history of acute or chronic intestinal disease. Details of 2 necropsies on cases in this category were given by Councilman: (1) A woman of eighty-five years with the entire abdominal aorta atheromatous, many thrombi on the calcareous plates, the largest just above the opening of the superior mesenteric and almost completely blocking the orifice of the artery. While the thrombus extended a short way into the vessel, the latter contained neither thrombi nor emboli. (2) A somewhat similar case of a man of sixty-one years, except the occlusion was midway between its origin and the bowel.

Venous occlusion is generally caused by a thrombus extending down; it may, however, be primary from some infection originating in the intestinal tract, notably appendicitis. Ochsner alludes to 5 examples in young individuals from alcoholic excesses. In the man of fifty-three years of age, seen by Rixford, venous occlusion was established by pancreatitis with fat necrosis.

The onset is often postoperative, following herniotomy, thyroidectomy (Maylard), gastroenterostomy, myomectomy, hemorrhoidectomy. In Douglas' case, a man of thirty-seven years, there had been appendectomy three months prior. In another man, aged twenty-six years, at Küttner's clinic in Breslau, referred to by Melchior, appendectomy on March 26; on April 6 and 8, chills, on 10 twice. Successful operation next day showed edematous mesentery. Smith's patient, a woman of twenty-eight years of age died after appendectomy. Fatal thrombosis of the mesenteric veins occurred after splenectomy in a woman of thirty-six years operated on August 22 and died on September 15. Several other cases are reported by Mauclaire and Jacoulet and Douglas following splenectomy. Finucci saw a patient of forty-three years of age about three days after a subtotal hysterectomy; a side-to-side anastomosis was unsuccessful. Smith, in a similar case, removed 15 inches of ileum, and made anastomosis successfully by the end-to-end plan. Of the 51 cases to which Robey alluded 24 were of surgical origin, 13 postoperative, with only 2 clean cases, and again, 6 were instances of acute appendicitis or peritonitis. In one of

Hedlund's patients, aged thirty-six years, after an operation for a tubal abortion, the pain persisted constantly. Another operation for the mesenteric occlusion failed. Many other instances of this postoperative type could be cited, but these will serve as samples. Curiously enough, Mauclaire and Jacoulet state, operations on the mesentery itself are not often responsible.

Trauma is apparently an occasional cause: Thus in the youth of seventeen years seen by Eisenberg and Schlink, fatal occlusion followed a fall striking the abdomen on a cement floor. A man of thirty-seven years, in railway station struck his abdomen against a car step, a month later there was a sudden onset of pain and vomiting. A side-to-side anastomosis failed. In Kojeff's case, necropsy showed an old clot in superior mesenteric vein obliterating it and microscopic examination disclosed an old rupture of the venous wall. In Klein's case a man of sixty-one years, forty-two days after a fracture of the femur, there was an acute obstruction for forty-four hours, with bloody vomitus, then profuse and watery diarrhea with blood, who recovered without operation but it was presumed to be this variety of occlusion. Addison operated on a woman aged forty-two years, with a history of unusual muscular exertion upon lifting 3 days prior followed by a large swelling in lower half of abdomen, containing blood-stained fluid at operation fifteen hours after the onset, there was a sharp line of demarcation and about 12 inches of bowel was successfully resected. Postoperatively there were some slight cardiac changes. Munro's patient, a man of fifty-one years, also gave a history of heavy lifting, as likewise in Cave's case of another man, aged forty-two years. Cawadias and Catsaras give the details of a case in a man aged thirty-three years, with a strangulated hernia with involvement of 24 inches of bowel. He died in a few hours. For six years there had been intermittent claudication. At necropsy sclerosis of the aorta, coronary, iliac, femoral and mesenteric arteries were found. The primary intermittent claudication came from stenosis of the iliac or femoral artery; five years later he had angina due to the aortic lesion and he died from intestinal infarction, the terminal syndrome of mesenteric arteritis. An intermittent claudication was noted in a man, aged thirty-two years, seen recently by Taube.

Bedridden patients may be attacked; for example, a woman aged seventy-nine years, seen by Selby, developed this condition after twelve days' rest in bed for fibrillation. Another of Hedlund's patient, of the same sex and age, was affected during pneumonia. At necropsy a liter of pus was present in the abdomen and six inches of the ileum was gangrenous.

Lastly, in a considerable number, principally venous occlusions, no sufficient cause can be found to produce the condition. The experimental work is inconclusive for humans, the duodenum or terminal ileum being involved rarely.

PATHOLOGY

The arteries were occluded in 371 cases, and the veins in 258 (Brady, Cokkinis, Jackson, Larson, Reich). Of 267 instances, the superior mesenteric artery was involved 237 times, the inferior 6 times, and both 24 times (Blackburn, Reich, Trotter).

With this preponderance of the superior mesenteric vessel, it is evident the lower part of the jejunum and the ileum will be most affected. The extent involved may vary from only a few centimeters to the whole of the small intestine, and the cecum, ascending colon, and even part of the transverse colon, as in Cave's case.

Whether this occlusion of the superior mesenteric artery is sudden or gradual, we may have: (1) obstruction of the intestine without infarction, the vascular supply while not enough to maintain physiologic function is adequate to nourish the intestinal tunics. (2) Infarction of the intestine, usually hemorrhagic in type, the anemic being exceptional. In one of Councilman's cases, a man of sixty-one

years, the hemorrhagic infarct involved almost the entire small intestine by occlusion of the artery from its beginning. Here the damage ranges from minor lesions in the mucous lining to gangrene of the whole wall. (3) A collateral circulation may ensue which may continue through the life of the individual, as in the cases of Chiene, Trotter and Ophüls to be narrated shortly. Or, the cardiac or arterial disease may increase and overcome this collateral circulation.

Of 157 individuals, the jejunum was affected in 34, the ileum in 47, most of the small bowel in 35, and the small as well as the large in 41 (Cokkinis, Reich). Curry and Backus successfully operated on a man, aged sixty years, in whom there was 12 inches of gangrenous midjejunum, which seems to be an infrequent site. Cokkinis states that in only 17 of his 42 cases did the extent of the affected bowel exceed 8 feet and in 2 of these 17, it was under 10 feet. However, in a woman of forty-eight years, nearly all of the small intestine, cecum and much of the ascending colon were gangrenous (Cave). Actual gangrene was found in 29 of Cokkinis' 42 cases.

Wulsten not only made a correct preoperative diagnosis but operated successfully in a man of sixty-four years, in whom the superior mesenteric artery was blocked completely by clots to its remotest branch. Occasionally, as in Schley's successful operation in a man of forty-two years, the arteries bleed during operation but the veins are thrombosed; so too, in Douglas' case.

In Chiene's case, in a woman aged sixty-five years, and a dissecting room subject, there was an ancient embolism of the celiac axis and mesenteric arteries. An aneurysmal sac was present from which the inferior mesenteric sprung. While both arteries were obliterated at their origin, the branches were filled with the injection mass, proving collateral circulation had been established. Long after this finding, Trotter saw a man of forty-six years, also with an aneurysm, though there was a complete closure of the superior and partial of the inferior artery, yet no symptoms ensued owing to complete collateral circulation. Symptoms of aneurysm had been noted for twenty-seven years. In the man, aged thirty-five years to whom Rixford referred, a dissecting aneurysm of the aorta established a mesenteric occlusion by pressure of the blood between the adventitia and the media. In an exceptional case, the superior mesenteric artery was closed by an old adherent embolus, and in spite of this the small bowel was found normal, Ophüls cites.

The occluded segment may be sharply defined, as in my case, but often gradually shades off, as in Lothrop's case. The contents are "generally dark, offensive, semifluid material which is either streaked with blood, or consists of almost pure blood . . . partly clotted, tarry, or dark red and liquid. . . . may be present in the lumen when none passed per rectum or vomited . . . generally an accompaniment of gas" Trotter).

Free fluid in the peritoneum is of three types: (1) pure ascitic fluid, always from cirrhosis of the liver or endocarditis; (2) seropus or purulent after peritonitis develops; (3) blood stained fluid or actual blood, of a few ounces to three or four pints, is the only variety caused by the occlusion itself. These three may coexist (Cokkinis).

As just stated occlusion of the inferior mesenteric artery is uncommon. Brown and Dey record an example in a woman aged forty-five years, who was admitted for a gastroenteritis; at operation the lesion was sharply demarcated and no pulsation was detected in the artery. In Ferguson's case, a man of sixty-four years, a patch of atheroma surrounded the orifice of the inferior mesenteric and a fragment occluded the lumen. Both ended fatally despite intervention.

Of 137 instances of venous thrombosis, there was infarction in 91 and in 60 of these again, from thrombosis or other morbid condition in the portal vein

(Trotter). Primary venous thrombosis is rare, 4 of the 57 personal cases, all occurred in superior mesenteric vein. In 40 cases of secondary venous thrombosis, 27 were in the superior vein and 13 were doubtful. Primary thrombosis of the mesenteric arteries, apart from embolism is uncommon, 2 only occurring in 79 instances (Cokkinis).

SYMPTOMS

Since the extent of the bowel in which the circulation is blocked varies from a few inches to many feet, it is evident that no clear cut clinical picture will be present. As a rule, the condition cannot be differentiated from acute ileus, such as is due to intussusception, volvulus and other causes. Nevertheless, there are two types, acute and chronic, the former with sudden, fulminating onset, sharp, agonizing pain, nausea and vomiting and bloody diarrhea, generally follows arterial obstruction alone or combined with venous. On the other hand, in the chronic type, generally in venous obstruction, the onset is frequently insidious; there may even be no manifestations referable to the abdomen.

Pain is the most characteristic symptom present in the great majority of cases. It is severe and agonizing, at first colicky and intermittent, later becoming constant. The severity seems decidedly disproportionate to the clinical findings. It is not relieved by morphia, enemata or the usual measures; in Brown and Dey's case morphia had no effect, in one of Frank's cases, a boy of eight years, no result was had from enemata, and in Selby's patient, drugs had no effect for six hours. The pain is generally situated about the umbilicus or epigastrium but may become generalized. Moreover, it may shift its location from the umbilical or epigastric regions to the right lower quadrant, then, of course simulating appendicitis; in short, the painful phenomena of "acute abdomen" suggesting exploratory laparotomy.

Temperature may be normal or even subnormal at the start, but in nearly every instance rises steadily.

Pulse grows progressively more rapid, and quickly assumes that typical of acute hemorrhage, small, hard, rapid, 100 to 140 or 150, and often irregular.

Distention is one of the most constant signs, usually makes its appearance early, increases gradually, and may affect only the upper or lower half of the abdomen.

Palpable mass, though present in my case, is often difficult to elicit because of the distention, tenderness and rigidity. Visible peristalsis is excessively infrequent, Trotter found it noted in but 4 of 360 cases.

Vomiting is another early and constant symptom, it may lessen in a few hours or persist. At first alimentary, it then may contain blood, in 16 per cent, according to Reich. While in my case the vomiting was fecal in character, this is uncommon, occurring in 2 of 76 cases reported by Cokkinis. Though hematemesis is of great significance, it is less common than melena.

Constipation and Diarrhea. Neither of these is typical, one may occur singly, sometimes both or neither may be present. Sometimes, again, both may be present at different times. Reich states diarrhea is found in 41 per cent of the cases and in 26 per cent the stools contain blood.

Absence of Symptoms. In the 4 cases of mesenteric thrombosis among the 1600 necropsies at Johns Hopkins Hospital, to which Schley alluded, the diagnosis had not been made as they caused few symptoms or none at all. Ingebrigtssen also, recording the findings in 6 necropsies, states in 2 there had been no symptoms. The woman, of seventy-eight years, to whom Watson referred, was brought in unconscious after a fall in the street. The temperature was normal. There were no abdominal symptoms whatever during the three days till death. At necropsy there was thrombosis of the superior artery and 20 inches of dark red ileum.

DIAGNOSIS

Küssmaul, the first to diagnose embolism of the mesenteric arteries wrote:

"This diagnosis is to be made when, under circumstances permitting the assumption of embolism, intestinal bleeding, enteritis or peritonitis occur, without there being any cause for these manifestations." It is not so easily established apparently, for it was made but 13 times among the 360 examples collected by Trotter, and quoted so frequently in this article.

Marked leucocytosis is one of the outstanding features of the disease, a white count out of all proportion generally to the apparent severity of the illness (Warren and Eberhard).

In their report to the 1935 session of the French Surgical Congress, Ameline and Lefevre suggest that the blood picture is possibly destined to render much aid in the diagnosis. They too, call attention to the marked leucocytosis, especially of polynuclears. Indicanuria is stressed as a diagnostic aid by Smith. A distinction between arterial and venous type, even if possible, would be merely of academic interest.

Among the many previous preoperative diagnoses may be cited gastroenteritis, acute appendicitis, acute pancreatitis, strangulated hernia, typhoid perforation and torsion of an ovarian cyst.

PROGNOSIS

Prognosis is serious, the mortality in the first large series collected by Jackson, Porter and Quinby in 1904, was 92 per cent, at that time surgical therapy was not so common as at present. Though many years later, of Cokkinis' 76 instances there were 30 deaths, or 83 per cent, in the 36 operations, while in the 40 not operated on 39 died. This same author states of the 36 cases, the average duration of life from the onset was three days, omitting the 4 exceptional cases, and in 12 cases less than forty-eight hours. The duration evidently depends on the amount of bowel involved, though exceptions, as always are met; in one instance practically the entire bowel was involved in one day's time, in another only a few feet were affected after a lapse of a week. The venous obstruction is less dangerous, but as already stated is unfortunately less common.

Councilman was not very good as a prophet: He concludes his account of 3 necropsies by observing, "It is important to know that obstruction of the superior mesenteric may give rise to paralysis of the intestine, obstruction, and to peritonitis, and it is a condition which is beyond surgical interference," yet a few months later his fellow-citizen, Elliot, was the first to operate successfully for this type of lesion.

TREATMENT

Elliot's successful intervention was the first, though the fourth with operative treatment: A man of twenty-five years, with an inguinal hernia, taxis elsewhere some ten months prior was painful. At operation twenty hours after the onset, 48 inches of ileum were resected, with formation of an artificial anus, uniting the ends 17 days later. The specimen showed that the veins were involved.

At various times resort has been made to enterostomy, exteriorization, resection and simple exploration. The exact method followed, assuming this is adequate to dispose of the damaged bowel and the obstructed vessels, seems of less importance than the state of the necrotic intestine and how long absorption there has been from it. Acupuncture may be helpful, as in my case, for the escape of fluid blood shows the wall is probably viable.

In 69 cases by 43 different observers in the last fourteen years, there were no recoveries from 10 enterostomies nor from 4 exteriorizations. Of 9 attempts at secondary closure 4 recovered. In 18 laparotomies there were 6 successes; in 32 resections with immediate anastomosis 21 succeeded, according to Dunphy and Zollinger. Of Loobe's 9 operations on subjects aged twenty to sixty-four years, but one was successful, a woman, aged forty-six years; and 3 of Ross' 4 operations failed, while D'Abreu had no recovery

from his 2 exploratory operations and 3 resections.

Trotter states 11 cases were treated as in mine, by resection and end-to-end anastomosis with the Murphy button, and 5 recovered. In Bonnot's patient, a woman of twenty-eight years, the stay of the button was even longer than in my case, it was still in place at the end of the fifth week, but was passed in two days more.

The latest collection, by Ameline and Lefebvre in 1935 deals with a series of 450 collected cases, 87 deaths and 21 recoveries in 108 explorations; and 137 deaths with 93 recoveries in 230 resections, etc.

Some 30 simple explorations alluded by Trotter were all unsuccessful; nevertheless, in the case under the care of Wilson, at laparotomy a collection of firm nodular clots were found in the superior mesenteric vein completely blocking the lumen. Recovery ensued after closure of the abdomen and drainage. The success here though gradual, was evidently due to the inferior vein assuming the functions of its larger neighbor. Similar cases were those of a boy of ten years, reported by Laws, and a man of fifty-one years reported by Ross.

Still another instance of "spontaneous recovery" is recently furnished from South Africa by Sargent: A man of seventy-four years, was admitted with intense pain of sudden onset and about four hours' duration; no history of similar attacks or of abdominal disease; morphine addict for a long time. The pain was most severe just above and to the left of the umbilicus. At operation, a dilated loop of ileum some 48 inches long, with dark plum colored walls, bled very easily. The mesentery was much thickened and gangrenous in places. No pulsation was detected in the mesenteric vessels. Resection was decided as unwise because of the age, poor condition and length of the bowel involved. The abdomen was closed with as little handling of the contents as possible. Vomiting of clear, bile-stained fluid, persisted for three days and for three days more he hiccupped continuously. During this time the stools were slightly suggestive of melena. In a week "with dramatic suddenness" the pain, vomiting and hiccup ceased, the stools became normal, and a fortnight postoperatively had "almost completely recovered."

A few years since Sjovall successfully resected 4.5 meters of intestine for occlusion of the superior mesenteric artery in a woman of forty-four years. The temperature was normal on admission and pulse was 90. In this connection some other extensive resections are of interest: Flint, in 1912, collected 58 examples where over 200 cm. had been excised, 9 were unsuccessful. The most marked one was that of Brenner in which 540 cm. were removed for gangrenous hernia; the patient succumbed to inanition two and one-half years later. Since his article several others have been placed on record: 336 cm. in a youth of twenty years, reported by McGuire; 15 feet reported by Sarnoff. In a man of fifty-two years, Doerfler left 4.8 inches of the upper segment and 8 inches of the lower after operating for a volvulus, excising all the rest; 19 feet were removed by Jerauld and Washburn; 102¾ inches by Garner and Bisset, and 120 inches by Skinner. The last 6 cases were not done for occlusion, but the next 2 were, Wulsten removing all but 6 inches of jejunum, and 4 inches of ileum; and Banke excised 435 cm. in a man of forty-seven years but it was uncertain whether the arteries or veins were blocked.

Haymond has quite recently analyzed 257 examples of "massive resection" of the small intestine, that is, from 200 cm. to 800 cm. and up. Over half, or 143 cases had resections of 200 to 299 cm. There were 86 deaths or 33.5 per cent, and it is interesting to find that the largest resection of over 800 cm. was successful. Some 34 of the total number were for mesenteric occlusion with 14 deaths (41.2 per cent).

CASE REPORT

Mrs. M. V., aged forty-eight years was admitted June 20, 1935.

Past History: Diseases of childhood unimportant. Menarche at thirteen years, regular, very little distress. She was married at twenty-six, had had one abortion but no other pregnancy. Tonsillectomy was done at the age of thirty-six years. She had an attack of renal colic in 1917 when a small stone was passed; acute bilateral otitis media in 1928 with spontaneous drainage and complete recovery. A supravaginal hysterectomy for fibromyoma uteri, without removal of the ovaries, was done in 1933. One year later she had moderate gas pains for an hour or more at irregular intervals, but not severe enough to interfere with her work.

Present History: On June 18, she was awakened about 3 A.M. by severe pain referred to the epigastric region; aching in character and of steadily increasing intensity. When seen two hours later the pain was referred to the hypogastric region and to the right; the abdomen at this time was negative to palpation with no increase of pulse rate and normal temperature. As the patient described the pain as very similar to the renal colic of 1917, a definite diagnosis was deferred. However, there was no pain referred to either kidney and the urine was negative and no bladder irritation. Morphine was administered and a waiting policy followed. No vomiting till 3 P.M., when she tried some light nourishment. Morphine was given at 7 P.M. and she passed a quiet night.

She awoke at 7 A.M. with a recurrence of the severe, constant pain in the lower and right abdomen, but there was now added an intermittent colicky pain referred to left abdomen, independent of the constant pain on the opposite side. This combination was very confusing, in fact inexplicable. There was no rise in pulse rate or temperature. Morphine again relieved the suffering and she was fairly comfortable for the remainder of the day and night. There had been no vomiting except the one attack mentioned.

The next day the patient was seen at noon, she complained of severe pain of the same constant, intermittent type. Vomiting began at 7 A.M. and by 9 o'clock became fecal. She was now examined again: The abdomen showed moderate distention; a mass was felt in the midline rising nearly to the umbilicus and extending to the right inguinal region; this was tender, tense, about the size of a small fibroid and could not be displaced. There was still no increase in pulse or temperature. A diagnosis of intestinal obstruction combined with some obscure condition, more probably intussusception was made, though nothing supported this idea except the tumor. She was sent to the hospital. The admission temperature was 99°; pulse 94 and respiration 24. Blood-count showed 4,500,000 erythrocytes and 13,700 leucocytes, with neutrophiles 82 per cent and lymphocytes, 18 per cent. The urine showed no pathology.

Preoperative diagnosis. Acute intestinal obstruction.

Anesthetic. Morphine gr. ⅙, atropine gr. 100; ethylene, ether and oxygen.

Assisting surgeon. Gordon W. Abbott.

Examination of field under anesthetic: The scar from the former operation extended ⅕ of the distance from the umbilicus to the pubes. A firm and seemingly immobile mass could be felt in the midline to the right of and below the umbilicus; the abdomen slightly distended. The field was sterilized by iodine and draped.

Operation: A median incision, coextensive with and including the scar was made; great care was taken in opening the peritoneum to avoid the intestinal adhesion to the cicatrix; the normal intestinal loops were protected by gauze pads and some free fluid was removed from the abdominal cavity. A loop of small bowel was adherent to the upper end of the scar tissue and occluded; it was freed, carrying with it a piece of parietal peritoneum, restoring its lumen.

In the pelvis was a tense and adherent black mass, which extended to the right and was evidently the tumor felt during the examination. A syringe inserted into it withdrew dark blood. When the needle was withdrawn, gas escaped, indicating a gangrenous loop. This mass, evidently a part of the lower ileum, was bound down by velamentous adhesions to the surrounding structures. It was easily liberated, and drawn out of the abdomen and laid on moist gauze pads. The contents of peritoneal cavity were protected by additional moist pads. The affected portion was 30 cm. long and sharply demarcated.

Clamps were applied to the loop, 7.5 cm. from the gangrenous portion on each side, dividing the intestines between them; the mesentery was gradually cut to a V-shape, picking up vessels

as they were divided. No particular difficulty was encountered in controlling hemorrhage; an additional 8 cm. of proximal gut was removed with a part of the mesentery because of the doubtful blood supply. The mesentery was sutured and the bowel was reunited with a Murphy button. The distal loop at the point of union seemed too cyanotic, but pressure blanched it and circulation returned immediately on release, while the serous surface was shiny. The loop was returned to the cavity, and the ileum and cecum were found fully dilated. The wound was closed without drainage.

The report of the National Pathological Laboratories on the specimen was: "A large portion of resected bowel in two pieces, 8 × 2.5 cm., and 30 × 4.5 cm. The serosa is dull gray to crimson, markedly discolored by hemorrhages. On sectioning the vessels in the mesentery and in the bowel are distended with clotted blood. The mucosa is necrotic. *Microscopic diagnosis:* Acute hemorrhagic infarction with necrosis and acute purulent inflammation of intestine."

Postoperative course: Temperature ranged between 98° and 100°F. until the sixth day, when it rose to 102°; the wound was distended with a foul smelling, thin exudate which was removed. Moist dressings were applied after inserting a rubber tissue drain. On the ninth day, the temperature dropped to 98°, then ranged between 97° and 100° until fifteenth day, when 101° was recorded, to fall again next day to 98° then varied but slightly till discharge.

The passage of the button was not noted, but an *x*-ray on the twenty-fifth day, failed to show its presence. She left the hospital on the thirty-fourth day. Her history since has been uneventful.

Treatment: Preoperative enemas were without result. The stomach was irrigated with soda solution. Morphine sulphate, gr. ¼, was given an hour before operation. The pulse on return to her room was 140. Normal saline solution 1000 c.c. was given subcutaneously, followed an hour later by 1000 c.c. glucose intravenously. The pulse dropped rapidly and in twelve hours was 100. Respiration was not alarming at any time.

No postoperative enemas or Murphy drip were administered. Morphine was given through the fourth postoperative day, seven ¼ gr. doses being used. Lemonade *ad lib.* No nausea, gas pains or distention was evidenced. No nourishment taken until the fifth day, then chicken broth was given. The first light solid food was on the seventh day. The bowels moved spontaneously on the sixth day.

SUMMARY

This condition first recognized nearly a century ago, is uncommon, though not excessively so. For a long time it was merely a postmortem finding, but forty-odd years ago, Elliot was the first to record a successful intervention, the fourth attempt at surgical therapy. A few recoveries from simple exploration have been reported, but about half have been resected as in my case. The bowel was reunited by the Murphy button, and the convalescence was gratifyingly "smooth."

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[*For Remainder of References see p. 521.*]

SPONTANEOUS PERFORATION OF CARCINOMA OF STOMACH

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SPONTANEOUS perforation of the stomach from carcinoma is relatively rare. The majority of reports of such cases are found in the European literature; relatively little has been written on the subject in America. Aird in a recent publication presents a comprehensive discussion of the question based upon 79 case reports, summarizing the literature. According to this author two-thirds of the cases of perforated gastric carcinoma are fulminant in their course, closely resemble perforated peptic ulcer in their symptoms and signs, and should be diagnosed as perforations of the stomach. In one-fifth of the cases rigidity was not pronounced or was totally absent. In one-third of the cases pain was slight or absent. The exact clinical diagnosis of perforated carcinoma rather than perforated ulcer is possible only if the gastric tumor has been previously diagnosed. In nearly one-half of the cases gross metastases were present when perforation occurred.

In connection with the question of surgical management of perforated gastric carcinoma the following case history is presented:

O. A., (132357) white male aged forty-two years, was admitted to the Medical Service of the University of Chicago Clinics, July 16, 1935. In 1925, severe burning epigastric pain developed about two hours after meals and would be relieved by eating or drinking milk, and aggravated by fruit juices. He also noted that the pain would improve with general rest and become aggravated by excess physical activity. In 1929, while under observation in another hospital he learned that taking an enema would relieve his pain, and on several occasions has resorted to this means for relief. There was no loss of weight, weakness or anorexia. On May 3, 1935 while in a street car he suddenly experienced very severe upper abdominal pain and found that he was unable to stand erect. He was seen by a physician who diagnosed perforated peptic ulcer and at another hospital a laparotomy was performed for repair of the perforation. At this time the carcinomatous nature of the lesion was appreciated by the operating surgeon but the writers were unable to obtain this information until after the patient was operated in this clinic. He was discharged ten days later in good condition and symptom free. During the latter part of June there was nausea on several occasions. Upon awaking in the morning of July 12, after sleeping well during the night, he experienced a strong desire to defecate, grew very dizzy and began to vomit blood and pass tarry stools. A physician administered an anti-coagulant and advised confinement to bed. During the three days prior to admission he was extremely weak but did not vomit; tarry stools continued.

On physical examination the patient appeared quite weak and pale, but mentally clear and cheerful; pulse 80, temperature 98°F. and respiration 22. There were no abnormal findings except the pallor and some constant tenderness and slight rigidity in the upper abdomen; there were no palpable masses. The blood pressure was 96/66. Red blood cell count was 3.600,000; hemoglobin 59 per cent; white blood cells 8,200; the urine was negative.

The clinical impression on admission was bleeding peptic ulcer. A regime of milk, cream and powders, with bed rest was instituted. The patient, however, continued to complain of severe burning pain in the epigastrium. A roentgenologic examination July 22 revealed an irregular crater about 4 cm. in diameter in the anterior wall of the gastric antrum and a constant duodenal bulb deformity. Gastric analysis showed free acid 5, total amount 15, no lactic acid or Boas-Oppler bacilli. Stool analysis for blood on three occasions revealed 4+ positive benzidine, two of these examina-

tions were made after two weeks on strict ulcer therapy.

The final clinical diagnosis made was carcinoma of the stomach and possibly an old duodenal ulcer.

On July 29, 1935, under ethylene-ether anesthesia the abdomen was entered by excision of the previous high midline incision scar. The stomach, quite mobile was brought through the wound and exhibited on its anterior wall at the junction of the lower third with the upper two-thirds a large disc-like, firm lesion about 6 cm. in diameter, to which considerable omentum was firmly adherent. The anterior wall of the first portion of the duodenum appeared cicatrized, but no evidence of active ulcer was present. There were many firm, enlarged lymph nodes in the mesenteries of the stomach but no evidence of liver metastases. A partial gastrectomy, with wide excision of adjacent mesenteries, was performed according to the Polya technique, removing approximately two-thirds of the stomach.

Convalescence was uneventful except for a sustained temperature of 102°F. for two days following operation due, undoubtedly, as chest roentgenograms revealed, to postoperative pulmonary atelectasis that involved a portion of the left upper lobe, which disappeared in a few days. The patient was discharged, seventeen days after operation, symptom free and on a general diet.

Pathologic Study. Gross. The lower two-thirds of the stomach removed, contains on the anterior wall in the midportion of the specimen a large crater, 4 cm. in diameter, with raised rolled edges and gray firm base, and surrounded by a wide zone of induration. Embedded in the crater are several loose sutures of non-absorbable material that were inserted at the time of the repair of the perforation. There are also several large open veins present in the floor of the lesion, into which a probe may easily be inserted. Some of these veins extend into the large mass of omentum that is adherent to the serosal aspect of the lesion.

Microscopic. Sections through the margin of the lesion show masses of carcinoma cells, many of them typical signet ring cells, invading all layers of the stomach wall. Sections of regional lymph nodes show partial to complete replacement of lymphoid tissue by carcinoma.

Pathologic Diagnosis. Colloid carcinoma of stomach, lymph node metastases.

The patient was last seen April 3, 1935,

Fig. 1. Photograph of ulcerating carcinoma of the stomach from specimen removed at operation two and one-half months following surgical repair of spontaneous perforation. In the left margin of the ulceration there remains a linen suture that was inserted at the first operation. In the floor of the crater are several patent openings into large veins.

apparently in good general condition and back at work. He stated that occasionally he has a clay colored stool. No masses are palpable in the abdomen. There has been a slight loss in weight.

DISCUSSION

In the series reviewed by Aird the immediate operative mortality from all types of surgical procedures was 50 to 60 per cent. The recorded results of various operative procedures are summarized by him as shown on page 510.

The results of primary gastrectomy appear far better than those obtained with other procedures, but to assume that this is the routine treatment of choice would not be justified. It must be remembered that such a procedure is attempted only in those

instances where the patient is in good general condition, where the neoplasm is small and when perforation is very recent. In evaluating the results presented in the above table it must also be borne in mind that "there is a tendency for solitary gastrectomy successes to be reported and for gastrectomy failures to be absent from the literature." From a theoretical standpoint, as emphasized by Aird, it would seem that the more conservative procedure would be closure of the perforation with gastroenterostomy if necessary, followed by a partial gastrectomy at a later date if no evidence of liver involvement was found at the first operation. The relative high primary mortality of partial gastrectomy for carcinoma as compared to that for gastrectomy for ulcer, would also tend to justify a conservative type of management for perforated carcinoma. Delaginière reported a case treated first by closure and later gastrectomy, that was well ten years following operation.

	Recovered	Died
Drainage alone	1	4
Closure alone	1	3
Closure and drainage	1	3
Local excision and closure	1	3
Closure and gastroenterostomy	5	7
Closure and jejunostomy	0	2
Jejunostomy only	0	1
Gastrectomy	7	0

SUMMARY

A case is reported as an example of the feasibility of conservative management and demonstrates the desirability of performing partial gastrectomy as soon as possible following recovery from closure of the perforation, and illustrates the dangers attendant upon long postponement of the partial gastrectomy.

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*Continued from p. 497.

MUCOCELE OF APPENDIX

REPORT OF TWO CASES, ONE CAUSING INTUSSUSCEPTION AND PARTIAL INTESTINAL OBSTRUCTION

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VIRCHOW,[1] in 1863, was the first to recognize cystic dilatation of the appendix and Feré,[2] in 1877 was the first to designate this condition as mucocele. Since that time, Dodge[3] in 1916 collected 142 reported cases; Davison,[4] in 1922 added 18 cases from the literature and one of his own, and Mayo and Fauster[5] in 1932 reviewed 76 cases. Dannreuther[6] recently reported 8 cases which were found in a series of 8457 appendectomies in a ten-year period at the New York Post-Graduate Hospital. These, in addition to numerous sporadic reports have brought the total number of reported cases of mucocele of the appendix to approximately 400. Because of the comparatively rare occurrence of this condition and because of the unusual complications, such as invagination, intussusception and intestinal obstruction which occasionally accompany it, the following 2 cases are reported.

CASE REPORTS

CASE 1. The patient was a woman thirty-four years of age who was seen first at the Cleveland Clinic on September 1, 1933. She stated that she had been well until six days before, when crampy pains developed in the abdomen, which were most marked in the region of the umbilicus and in the right lower quadrant of the abdomen. She also noticed an urgency to defecate, but had not been able to secure a satisfactory evacuation. These symptoms were accompanied by nausea but no vomiting. Enemas made the pain temporarily more severe, but after expulsion of the enema, the discomfort was considerably although not completely relieved. Bowel movements also gave temporary relief. On two occasions, the pain radiated to the right axillary region. Otherwise, nothing of significance was revealed by the history.

Physical Examination. Examination of the abdomen revealed it to be flat and soft. The liver and spleen were not palpable. There was, however, an irregular tender mass the size of an orange which was palpable just below and to the right of the umbilicus. Considerable tenderness could be elicited in the region of the appendix.

The patient was admitted to the Cleveland Clinic Hospital for observation and study. A barium enema revealed the cecum to be redundant and the roentgenologist reported "an apparent inspissated fecal mass in the ascending colon which shifted into the cecum," and that "the colon is very spastic and the enema reproduced the patient's abdominal distress."

After the patient had been in the hospital for two days, she was discharged at her own request. The clinical impression at that time was that the patient was suffering from a partial intestinal obstruction of doubtful etiology.

Two weeks following discharge, the patient returned to the hospital complaining of the same symptoms as those at her first visit, and an exploratory operation was advised. This was performed on September 20, 1933. When the abdomen was opened, a tumor mass could be palpated in the middle of the transverse colon. Inspection revealed that an intussusception was present which involved the cecum and ascending colon. These structures had telescoped up into the transverse colon and produced the tumor mass. This condition was corrected in the usual manner, at which time it was then seen that the appendix was many times larger than normal, freely movable, and that it consisted of a fluctuant mass which involved the base of the cecum. The lower end of the cecum, including the appendix, was removed between Payr's clamps in such a way

as to maintain the normal opening of the ileum into the cecum (Fig. 1).

Pathological Examination. The specimen

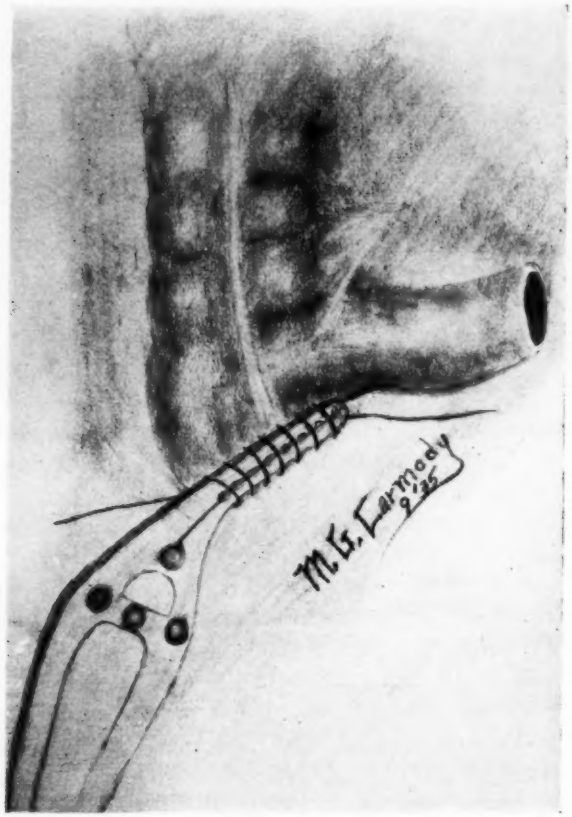

Fig. 1. Drawing showing use of Payr's clamps.

weighed 70 grams (Figs. 2 and 3). The opening of the appendix into the cecum was almost entirely closed over and the base of the appendix, which was greatly dilated, bulged into the lumen of the cecum. On opening the specimen, it was found to contain a large amount of tenacious, gelatinous, yellow, mucinous material.

Microscopic examination showed a greatly dilated lumen, with flattened mucosa, enlarged mucosal glands, very little lymphoid tissue, almost no recognizable submucosa, and a thin muscular coat which showed diffuse fibrosis and mild chronic inflammatory reaction. Another section through the appendix showed a greatly dilated lumen. The mucosa was represented by a straight line of columnar epithelial cells, not forming tubular glands and resting on a fibrous stroma. There was very little lymphoid tissue, almost no submucosa, atrophy and fibrosis of the muscular coat, and mild inflammatory reaction.

The pathological diagnosis was mucocele of appendix and chronic appendicitis.

It is quite apparent then that when the barium enema was given for the *x*-ray examination, undoubtedly the pressure in-

Fig. 2. Fig. 3.

Fig. 2. Photograph of specimen. (Case 1.)
Fig. 3. Photograph of specimen. (Case 1.)

side the colon reduced the intussusception, giving the examiner the impression that something was being pushed away.

Case II. The patient was a woman sixty-two years of age who was seen February 19, 1932, complaining of pain in the right lower portion of the abdomen which came on from one-half to one hour after meals. This pain was more severe after greasy foods had been eaten. This condition was associated with occasional vomiting and constipation. There was no gross hematuria or melena. Rectal examination revealed a firm mass anteriorly and to the right which was extrarectal. There was some tenderness in the left side of the pelvis. In the right lower quadrant in the region of the cecum, an ill defined mass could be felt. A complete hysterectomy had been performed in 1917. Cystoscopic examination revealed no abnormalities. Protoscopic examination revealed no direct or indirect evidence of neoplasm in the sigmoid. Roentgenograms of the gastrointestinal tract showed that the gall bladder was functioning normally. No pathology in the stomach, duodenum or colon was evident.

An exploratory operation was advised and this was performed five days after the patient was first examined. The urinary bladder was found to be soft and flabby and contained about 200 c.c. of urine; its walls were slightly thickened and its veins were rather prominent. It was felt that the ureters and kidneys were normal. The gall bladder was small, of normal thickness, contained no stones and emptied readily. The duodenum, pancreas and stomach

were normal. The spleen was small. The entire pelvis was well peritonealized, the tubes, ovaries, and uterus being absent. In the sigmoid and upper rectum there were two firm, movable nodules in the wall of the bowel, but these showed no gross pathology. They felt like calcified intramural nodules and were about the size of a navy bean or slightly larger. When the cecum was picked up, a tumor mass was felt laterally. The cecum, ileum and ileocecal valve were identified and then retracted; a tumor mass could be seen lateral to the cecum which was displaced medially.

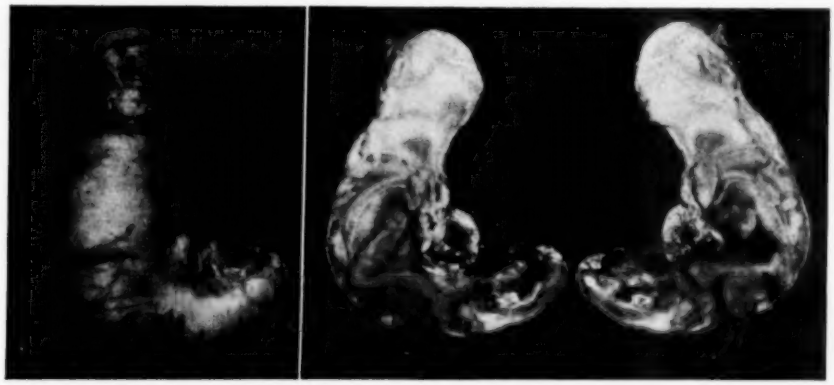

Fig. 4. Photograph of specimen. (Case 11.)

Fig. 5. Photograph of specimen. (Case 11.)

This tumor mass was the size of a large sausage and it came off the lower part of the cecum where the appendix normally is found. It curved upwards and its tip was about the size of the distal portion of a little finger. Proximal to this tip, there was a nodular swelling from which the tip arose to curl towards the ascending colon. Grossly, it appeared as a mucocele of the appendix, and was removed. Following the operation, the patient made an uneventful recovery.

Pathological Examination. The specimen weighed 90 grams, was definitely cystic in nature and measured 8 cm. along each arm of its angular bend and varied from 2 to 4 cm. in diameter (Fig. 4). Gross examination showed it to be greatly distended and distorted in outline. It was bent upon itself to a 90° angle in its midportion and held in this position by strands of fibrous adhesions which extended over its surface. The serous surface, aside from a few old fibrous tags, was smooth and regular.

Longitudinal section (Fig. 5) showed it to be thin walled in its proximal portion and filled with gelatinous, opaque, yellowish-white, mucinous material. Its distal portion was filled with more firm, waxy mucinous material with yellowish-white areas of a finely granular character scattered through it.

Microscopic section revealed a very thin walled appendix with fibrosis of the peritoneal and submucous coats, atrophy of the muscular coat and a relatively flattened mucosa of very shallow glands with swollen epithelium and considerable mucus in the cells.

A pathologic diagnosis of mucocele of the appendix was made.

Both of these patients are in good health at the present time, and it is interesting that in neither case was there any evidence of pseudomyxoma peritonaei at the time of operation, so of course the prognosis as far as this is concerned should be excellent. We can derive nothing from the histories or clinical findings in either of these cases that gives indication of the duration of the condition before operation.

Etiology. As a result of an attack of acute appendicitis which has subsided spontaneously, it occasionally happens that a slow, obliterating process takes place. This is usually inflammatory in nature and occurs between a secreting area and the base of the appendix. Lifvendahl and Ries[7] have indicated that complete occlusion is not always necessary to produce this condition. They also question another time honored prerequisite for the development of this condition which was set forth by Elbe,[8] namely, that a sterile lumen is necessary. These writers conclude that pathogenic organisms may have access to a mucocele without causing peritonitis, empyema, or gangrene of the organ. The predisposing inflammatory changes may be the result of such specific conditions as tuberculosis, syphilis and carcinoma, or of such mechanical factors as angulation and

gradual torsion by adhesions. If the original infection remains of such a low grade intensity that the mucous secreting cells are stimulated, the obliterated appendix then becomes distended with mucus which is secreted in excess of its absorption.

Associated with the condition, some physiologic alteration must occur in the mucosa whereby the normal mucus becomes changed to pseudomucin. It is probable that the secretion is at first mucoid, and in connection with this, there may be thickening of the mucosal and muscular coats. Later, the effects of continued pressure from within make themselves evident on the cyst walls and further products of hyaline or myxomatous degeneration of the fibrous elements are added which possibly lead to the gelatinous character of the contents. As the pressure becomes greater, herniations of the mucosa through the thin muscular coat may occur, producing small diverticuli. Such distension of the appendix may increase slowly until the organ becomes many times its normal size.

Size. Most mucoceles are globular in shape and a few reach an enormous size. Neumann[9] described one the size of a man's head in a patient sixty-nine years of age. Further progress in the distension of the organ may be interrupted at any stage by rupture of one of the diverticula and this results in a collapse of the appendix and the extrusion of mucus into the peritoneal cavity. The ruptured diverticulum then heals and an identical process begins over again.

Symptoms. This sequence of enlargement and rupture of diverticula may be repeated a number of times before clinical signs or symptoms are produced, and in many instances, the symptoms either are absent or obscured by other conditions. The patients usually complain of vague and indefinite distress in the right iliac fossa. Occasionally, a mass is palpable and a diagnosis of an ovarian cyst or intestinal tumor may be made. In a few rare cases, the appendix may become invaginated and cause symptoms of intestinal obstruction.

Diagnosis. A diagnosis of mucocele of the appendix seldom is made prior to exploratory operation or necropsy, although this may be said, a palpable mass in the region of the cecum, which is movable, only slightly tender, and is not associated with fever, weight loss, anemia or gastrointestinal disturbances other than perhaps a vague discomfort in this region, should always lead one to suspect the presence of a mucocele of the appendix.

Treatment. Appendectomy, of course, is the only treatment available and this should be performed as early as possible, before the mucin has spread too widely within the peritoneal cavity. As stated before, appendectomy does not always cure the condition in which case, death ensues sooner or later.

The method of treating Case 1 is interesting and worth remembering. That is, the lower end of the cecum was included and removed with the involved base of the appendix between Payr's clamps in such a way that the normal opening from the ileum was maintained (Fig. 1). Then by using a Parker-Kerr basting stitch and removing the Payr's clamp, the opening in the cecum was closed. This area was then reinforced by serosal sutures.

Complications and Prognosis. The most common and most important complication of mucocele of the appendix is its rupture. The extruded mucus is not absorbed but becomes implanted on the peritoneal surfaces in the form of droplets, which are encapsulated by a growth of filmy connective tissue, produced as a result of the localized peritonitis. This condition is known as pseudomyxoma peritonaei and is analogous to that which occurs from the rupture of a pseudomucinous cystadenoma of the ovary. The production of mucus within the peritoneal cavity from a mucocele of the appendix may be checked by removal of the organ. In a few cases, however, appendectomy has no influence on the condition. In such instances of pseudomyxoma peritonaei, large gelatinous globular masses of viscid, mucoid material which resemble masses of frog's spawn, form and penetrate every part of the peritoneal cavity. The abdomen becomes mark-

edly distended by this newly produced material. The distention is often great enough to interfere with respiration. It is evident that such a process necessarily becomes a type of malignant growth. The explanation of this apparent anomaly probably is that epithelial cells become implanted upon the peritoneal surfaces and continue to reproduce the gelatinous, mucinous material of the original growth, or that possibly the presence of the material acts as an irritant to the peritoneum and causes it to react by further production of similar masses. The prognosis then becomes unfavorable, although repeated operations may secure relief for a number of years. Death finally comes as a result of either sepsis, embolism or intestinal obstruction, the latter being caused by the formation of adhesions.

Masson and Hamrick[10] believe that the prognosis in pseudomyxoma peritonaei of appendiceal origin should be better than that of ovarian origin in that the exudate remains limited to the right iliac fossa in the former instance.

Some other complications of mucocele of the appendix are intussusception, invagination, volvulus, intestinal obstruction and occurrence in hernial sacs. Mulsow,[11] Squires,[12] and Hall[13] have reported cases in which the mucocele had invaginated into the cecum and caused obstruction at the ileocecal valve. In the case reported by Mulsow, gangrene of the cecum and proximal portion of the appendix had occurred. Martin[14] described a case of intussusception caused by mucocele of the appendix in which the intussusception had extended to the middle of the transverse colon.

SUMMARY

1. Two cases of mucocele of the appendix are reported, one of which caused intussusception and partial intestinal obstruction in an adult. Complete recovery followed operation in each case.

2. Mucocele of the appendix is a rare, chronic condition which is seldom diagnosed before operation or necropsy. Its presence should be suspected in any case in which there is a movable palpable mass in the region of the cecum which is not associated with fever, loss of weight, anemia or gastrointestinal disturbances other than vague discomfort in this region.

3. Surgical removal of the appendix is the only method of treatment, and should be done as early as possible before pseudomyxomatous peritonaei develop which nearly always terminate fatally.

4. Other complications associated with mucocele of the appendix are intussusception, invagination, volvulus, intestinal obstruction and gangrene.

5. Surgical treatment may necessitate partial resection of the cecum as was necessary in Case 1, and the surgeon should be prepared to follow this procedure if it is necessary.

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RECURRENT INTESTINAL OBSTRUCTION DUE TO GALLSTONE

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INTESTINAL obstruction due to gallstones was first reported by Bartholin in 1654 and since that period various reports may be found. While not rare, the occurrence is seldom found oftener than once in 30,000 to 70,000 surgical cases. The incidence among the total cases of intestinal obstruction is estimated to lie between 0.5 and 2 per cent.

Stones may enter the bowel either by passage from the gall bladder through a dilated cystic or common duct, or by ulceration through the gall bladder and subsequent perforation into the bowel. A history of jaundice naturally points to the former type of mechanism. Ulceration through the gall bladder or perforation into the bowel may be followed by a localized or general peritonitis; and death result due to insufficient adhesions protecting the fistulous tract.

If a stone successfully enters the bowel by either route and causes mechanical obstruction, the diagnosis becomes difficult and is rarely made prior to operation. The onset of vomiting and the acute nature of the obstruction usually preclude gastrointestinal study. A flat *x*-ray plate of the abdomen may be of value at times. Many of these cases are seen late in the disease and the loss of fluids and the existent toxemia renders any surgical procedure quite formidable. A mortality of 60 to 70 per cent attends surgical intervention.

The following case seems to be of interest for three reasons: (1) the probable time that perforation of the gall bladder by the gallstone occurred can be conjectured; (2) the ball-valve type of obstruction caused by the gallstone, resulting in repeated attacks of intestinal obstruction apparently relieved by movement of the stone; and (3) the rapid loss of weight and marked gastrointestinal symptoms present for one year.

Mrs. B. A., white female, aged sixty years, entered the hospital on August 15, 1935, with a chief complaint of pain in the lower abdomen and vomiting.

Present Illness. During the past year patient noticed obstinate constipation associated with flatulence and sour eructations. Every twenty to thirty days during this time she had experienced acute attacks of pain in the epigastric region and left lower abdomen, accompanied by distention and protracted vomiting. These attacks were preceded by obstipation for three to four days and lasted about ten days. They were never relieved until the bowels moved, either after repeated enemata or numerous cathartics. There had been no diarrhea and she had never been jaundiced. Her appetite had decreased and during the past six months her diet was chiefly liquid. The average weight one year ago was 130 lbs. (59 kg.), the weight on admission was 74 lb. (33.6 kg.).

Two weeks prior to admission, the patient experienced a typical attack of pain and vomiting as described. She stated that her bowels had not moved during this time and that vomiting occurred every one to two hours. Pain in the epigastrium and left lower quadrant had been colicy in nature and grown more intense. She had received no medical attention as she lived seventy miles distant in an inaccessible part of the country.

Family history was essentially negative.

Past History. Menopause at fifty-two years was normal. She has had indigestion for ten years, qualitative in nature, with fulness and sour eructations after meals. At the onset of these symptoms she was examined by a physician, who told her that she had gallstones. No *x*-ray study was made. Four years later she experienced a sudden pain in the right upper quadrant associated with nausea and vomiting; abdominal distention and generalized pain were quite marked, and her condition became

critical for several days. There was no jaundice, coffee ground vomitus, tarry or clay colored stools. This illness lasted about ten days and the third and fourth days large quantities of fecal material were passed after frequent enemata. The patient was greatly improved

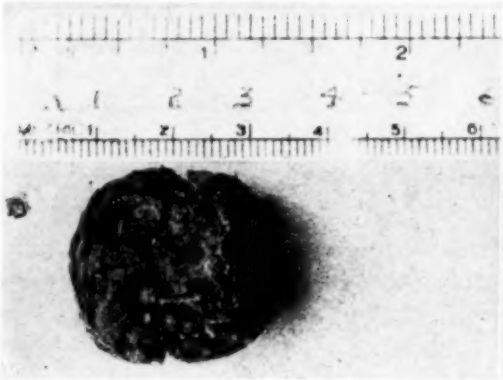

Fig. 1A. Gallstone causing recurrent intestinal obstruction.

Fig. 1B. Note layer of fecal impaction about original stone.

required morphine a number of times for relief. She had been free from pain until the onset of present illness one year ago.

Physical examination revealed a small woman, extremely ill, weighing 74 lb. (33.6 kg.). There was an obvious loss of panniculus, and extreme dehydration was evidenced by her dry skin and tongue. No jaundice was present. The pupils reacted to light and accommodation. Examination of the heart and lungs was negative. There was no adenopathy and the thyroid gland was not enlarged.

The abdomen was markedly distended and tympanitic, with generalized tenderness and involuntary rigidity. Rectal and pelvic examinations were negative.

The temperature on admission was 100.4°F., pulse 120 beats per minute and weak. The leukocytes numbered 21,300 with 87 per cent polymorphonuclear cells. The erythrocytes numbered 4,280,000, and the hemoglobin was 80 per cent, (Tallqvist). A catheterized urine specimen revealed a 3 plus albumin with 3 plus pus cells and many hyaline and granular casts.

A diagnosis of acute intestinal obstruction, probably due to malignancy of the bowel, was made. However, the patient was too critically ill to consider surgery at that time. Dehydration was combatted with intravenous and subcutaneous fluids. The Wangesteen continuous intestinal drainage was instituted with rapid relief of the distention and pain.

On the second day a small bowel movement was effected by an enema. Examination of the stool was negative for occult blood. During by the third day. The distention and pain had subsided, and after removal of the duodenal tube, she could retain liquids. For the next week she continued to improve and wished to go home. She refused gastrointestinal *x*-ray study and was dismissed without a definite final diagnosis.

One month later the patient was readmitted with a history of a recurrence of acute symptoms of one week's duration. She was not as dehydrated as on her previous admission, but she was extremely ill. A flat *x*-ray plate of the abdomen showed a small intestine obstruction, and the patient was prepared for surgery.

Under ether anesthesia, a low left rectus incision was made. Nearly 800 c.c. of straw colored fluid was present in the abdomen. A hard mass the size of a large marble was found completely occluding the ileum about 24 inches from its origin. The small bowel above this point was distended to three times its normal size and markedly engorged. Below the obstructing mass the bowel was collapsed. An intestinal clamp was applied above and below the mass, and the bowel opened by a longitudinal incision 2 inches in length opposite the mesentery. The mass was delivered and the intestinal mucosa was found to be smoothed out at this point. The intestinal incision was closed in the usual manner and an enterostomy was performed 8 inches proximal to the site of obstruction. Examination of the mass at the time of operation showed it to be a gallstone. (Figs. 1A and B.)

The abdominal incision was enlarged and the liver and gall bladder quickly explored, as the

condition of the patient was poor. The gall bladder was a hard contracted mass, about 1¼ inches (3.3 cm.) long and ½ inch (1.3 cm.) in diameter with numerous dense adhesions between the gall bladder, stomach and duodenum. The cavity was obliterated and contained no stones. On the lateral margin of the second portion of the duodenum could be seen an ill defined depression which apparently marked the point of entrance of the stone into the duodenum. The incision was closed in layers without drainage.

Examination of the specimen showed it to be a cholesterin stone, measuring 3 × 2¾ cm. and weighing 153 grains. There was a hard, smooth fecal layer, from 2 to 4 mm. in diameter, firmly adherent to the stone.

The postoperative convalescence was uneventful. The patient was out of bed within two weeks and left the hospital at the end of the third week. Two months later she reported a gain of 12 lb. (5 kg.), and stated that her former symptoms and constipation have not recurred.

COMMENT

The prolonged acute attack of right upper quadrant pain, as described, which the patient experienced a number of years previously, was probably the time that rupture of the stone from the gall bladder occurred. Movement of the stone down the intestinal tract was slow and seemed to be associated with frequent obstruction in which the gallstone acted as a ball-valve.

CONCLUSION

1. A case of intestinal obstruction from a gallstone is presented.
2. The approximate time of perforation from the gall bladder can be conjectured.
3. The rapid loss of weight, simulating a malignancy, together with recurrent attacks of intestinal obstruction from the stone, are of unusual notation.
4. Any case of intestinal obstruction with a previous history of gallstone colic may have an impacted gallstone in the intestinal tract. If this be kept in mind, this condition will be overlooked less frequently.

ISCHEMIC NECROSIS FROM ICE BAG "BURN"

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DEATH from exposure to cold has always been the fear of explorers in arctic regions and in high altitudes. Except in the feeble and in the chronic alcoholic, deaths from freezing are rare in the temperate zone, but chilblain, frost-bite and necrosis from cold are not uncommon. That ischemic necrosis of the superficial tissues may be caused by the therapeutic application of an ice bag is not generally appreciated even by physicians. In the literature available, practically nothing is found on it. Although not of paramount importance it merits consideration for the general use of the ice bag makes the subject of more than academic interest. Figure 2 shows ischemic necrosis of the abdominal wall of a well nourished young negress following the continuous application for five days, in midsummer of an unprotected ice bag for the relief of pelvic inflammation of tubal origin.

That heat and cold being so entirely different in character and in activity should produce, when applied locally, tissue changes that are almost identical is surprising. In each, three degrees of reaction are recognized by clinicians and by pathologists: (1) hyperemia; (2) bleb or blister, and (3) necrosis or gangrene.

When cold is applied there is a preliminary anemia of the part which is followed by a hyperemia. Each stage progresses into the next if the local application is of sufficient degree and duration. In ordinary cases of frost-bite as explained by Boyd[1] the main factor in the production of the gangrene is the ischemia due to extreme contraction of the blood vessels, together with damage to the capillaries with the formation of hyaline thrombi. "If the cold is sufficiently great the fluid of the cells is crystallized, and the cells are torn to pieces by ice crystals." MacCallum[2] says the noxious effect of freezing is explained either as due to tearing of the cells as the ice crystals are formed, or to the concentration of the salt around the crystals, or to the withdrawal of water from the cell to form ice. However, he attributes the gangrene of the extremities following exposure to cold as the result of protracted ischemia from extreme contraction of the blood vessels or their obstruction from thrombi. Adami[3] writes,

> It is not the active freezing of the tissues that induces cell death but the subsequent too sudden reestablishment of the circulation, with resultant paralytic dilatation of the vessels, intense exudation, and circulatory stasis leading to malnutrition. . . . That it is the vascular disturbance that is at fault and not the primary death of the cells through the freezing process is further indicated by the fact that similar gangrene may affect the extremities of those with enfeebled circulation, alcoholics etc., from mere immersion in cold water—i.e. above the freezing temperature.

That some kinds of fish may be frozen in solid ice and revive apparently unharmed when the ice melts is explained by the fact that the concentrated plasma in them freezes only at temperatures much lower than the freezing point of water. If the plasma freezes the fish die.

In the human the effect of exposure of a part to cold varies with the degree and the duration of chilling that results. Loss of heat from wet clothes, by conduction is much more rapid than by radiation from exposure to the atmosphere, although the ears, the nose, the cheeks and the fingers readily freeze when unprotected in cold,

[1] BOYD. Text Book of Pathology, 2nd Edition, 353.

[2] MACCALLUM. Text Book of Pathology, 1916 Edition, 369.

[3] ADAMI. Principles of Pathology, 2nd Edition, Vol. 1, 287.

windy weather. Freezing anesthetizes the skin so that the condition is often recognized first by the characteristic blanching.

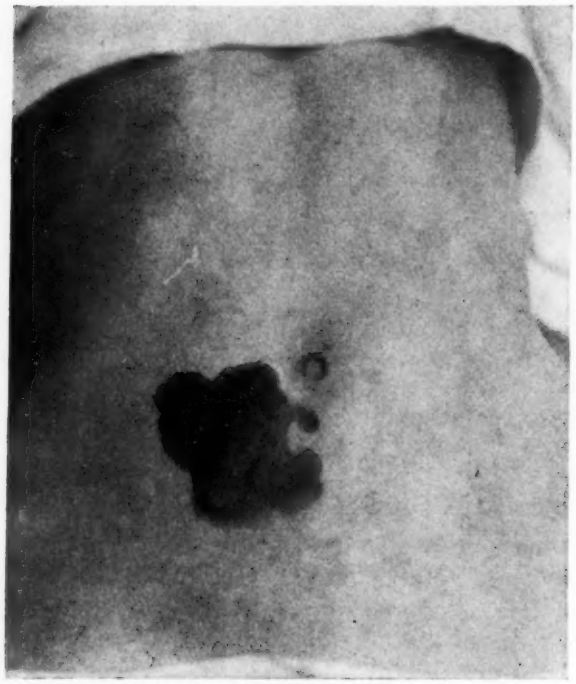

Fig. 1. First stage, hyperemia from two days continuous application of unprotected ice bag to right abdomen for appendicitis in white girl.

Because of the depressing effect on both the circulation and the sensory nerve endings, cold has for many years been used in the local treatment of inflammation of the active type. In order that the tissues shall be subjected only to the proper degree of cold the patient should be under close supervision. Too severe or too prolonged therapy lessens tissue vitality and hinders repair. Resistance of the body to cold varies with the age and the vigor of the individual; resistance of a part to cold varies with the blood supply but any area of skin may be frozen if the degree and the duration of exposure is sufficient. However, increasing experience has convinced me that cold has but little place in the treatment of inflammation in general surgery. I have yet to see a case of acute appendicitis relieved by the application of an ice-bag. The course of the disease is not effected and the symptoms are not abated. The custom of using an ice bag on every case of appendicitis before operation is a fetish of the past without practical merit. Any good derived from it is psychic, not physical.

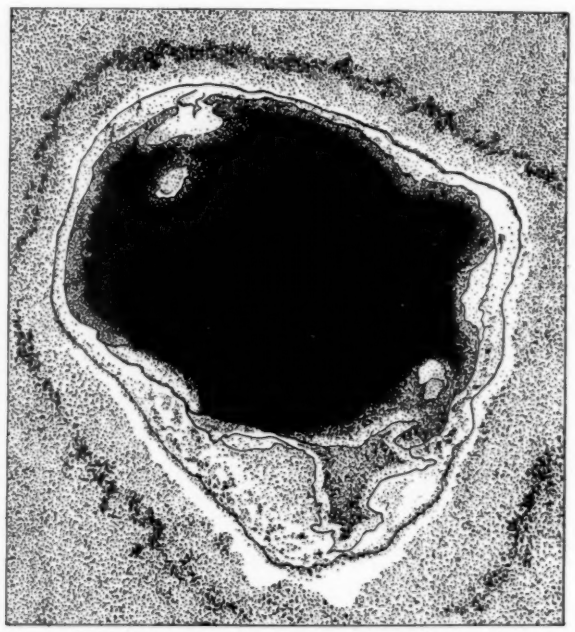

Fig. 2. Third stage, ischemic necrosis of skin and superficial tissues from five days continuous application of unprotected ice bag to the abdomen of well nourished negress for relief of pelvic peritonitis.

There is no such thing as "freezing out" an attack of appendicitis. From the hyperemia caused by the use of the bag there is an increased tendency to bleed at operation.

But if an ice bag is to be used proper application and care of it are necessary to protect the tissue from ischemia and burn. The bag must not come into direct contact with the skin, but one or more thicknesses of soft cloth or towel should be placed between the skin and the bag. The cloth not only acts as an insulating medium and moderates the degree of cold to which the skin is exposed but its greatest service is absorbing the moisture which condenses on the bag from the warm air of the room. It keeps the skin dry in this way. A leaky bag should never be used. There is a layer of air between a dry bag and the skin that tends to prevent freezing. When a wet bag is next to the skin this protecting layer of air is replaced by water and the loss of heat by conduction is much greater. The bag should not be kept on continually. After

two hours it should be removed for an hour and then reapplied. Some medical students say these principles are taught them in school. I find but little about them in surgical literature.

The treatment of ischemia from cold varies with the lesion. The effected part should be warmed very slowly. Any one who has ever been very cold has experienced the extreme pain caused in an extremity by warming the part too quickly. The white and bloodless tissue becomes red and swollen after thawing. The pain is from the reaction of the arteries to the sudden release from contraction and is best relieved by plunging the extremity into ice water or by rubbing it with snow. However, if the cells have crystallized from cold they are dead and care in thawing the effected part is of no avail. In the hyperemic stage of ice bag burn no treatment is necessary. In the bleb stage some mild antiseptic solution like mercurochrome may be applied. In the necrotic stage the treatment is that of necrosis from heat. Gangrene of an extremity is usually of the dry variety and amputation should be done when a line of demarkation forms.

SUMMARY

That an ice bag applied continuously may cause local tissue necrosis is not appreciated by physicians. The common use of the ice bag in the treatment of deep seated inflammation of the active type makes the possibility of burn from it of more than academic interest. The way in which local cold causes necrosis is discussed. The proper application of an icebag, to prevent burn, with one or more thicknesses of cloth between it and the skin to keep the skin at all times dry is explained. The necessity for slow warming of tissue after exposure to cold is noted.

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Continued from p. 507.

POSTTRAUMATIC THROMBOSIS OF INTERNAL CAROTID ARTERY*

REPORT OF TWO CASES

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CINCINNATI

IT MAY be difficult to evaluate the cerebral symptoms following traumatic thrombosis of the internal carotid artery, especially if the injury has been associated with a head injury, for the latent paralysis or aphasia may be attributed wrongly to the head injury. This occurred in one of our patients. Another instance was reported very fully in 1872 by M. Varneuil[1] of Paris. In his case the cerebral symptoms, consisting of right hemiplegia and aphasia, were attributed to the head injury until necropsy revealed a propagating thrombosis of the internal carotid artery and its branches.

Makins,[2] DaCosta,[3] Reid[4] and others report an incidence of cerebral complications in 20 to 30 per cent of the cases following ligation of the common or internal carotid arteries. The incidence of such symptoms is undoubtedly much greater following a widespread propagating thrombosis of these vessels as a result of contusion, laceration or fracture of the artery, although too few cases hgve been reported to permit the establishment of any accurate percentage figures. The late development of the cerebral symptoms and signs is undoubtedly of great significance in making a differential diagnosis. The main reason, however, for recording our 2 cases is the frequent error of attributing to concomitant head injuries the symptoms and signs which develop as a result of a traumatic thrombosis.

CASE 1. A colored male, sixteen years old, whose history was obtained from relatives. About ten hours before admission to the hospital, the patient fell on a hedge and received a penetrating wound of the soft palate. The immediate result was a moderate amount of bleeding, local pain and swelling but no loss of consciousness. Four hours later his physician examined the wound and recommended hot gargles. A few hours later the patient vomited, was unable to gargle, became drowsy and could not talk although he apparently understood what was said to him. As a result of increasing drowsiness and the development of a weakness of the right side of his body, he was brought to the hospital. Prior to the injury the boy was a normal, healthy child.

Pbysical Examination. The patient was well developed and nourished, quite drowsy but when aroused attempted to cooperate although he was unable to speak. His temperature was 99.8, pulse 88 and respiration 20. The skin was normal and the head showed no external signs of injury. The right upper eyelid seemed to droop and the patient could not completely close the right eye. The pupils were normal; there was no nystagmus; the corneal reflex was diminished on the right; the fundi appeared normal. The ears and nose were negative. There were twitching movements of both lips on the right side and he would not protrude his tongue. A jagged wound 2 cm. in diameter was seen in the roof of the mouth at the junction of the hard and soft palate, slightly to the left of the midline. There was no rigidity of the neck. The lungs and heart were essentially normal. The blood was pressure 130/60. The right arm showed a flaccid paralysis, while the right leg was somewhat spastic and moved very little even on painful stimulation. The deep reflexes in the right arm and right leg were hyperactive. Babinski, Oppenheim, and Chaddock signs were positive on the right side. The right abdominal and right cremasteric reflexes were absent.

The spinal fluid on admission contained no increase of cells or protein. There was no

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increase of pressure and the Queckenstedt sign was normal. The patient had three other spinal punctures, the last done three days after admission, which showed a cell count of 700 cells per cmm. The white blood count was 15,000. The patient was incontinent and no analysis of the urine was made. The Kahn test and the spinal fluid Wassermann were negative. A roentgenogram of the skull revealed no fracture.

Course in Hospital: The temperature rose slowly, one time reaching 103°F., accompanied by a slow pulse and his stupor increased. He developed rather marked tenderness on the left side of his neck just below the ear with a very perceptible decrease in the carotid pulsation. The drowsiness increased and the patient died six days after admission to the hospital.

At the necropsy the left internal carotid contained a well formed thrombus which extended from the cervical portion of the artery into the cranial portion and on into the middle cerebral and sylvian arteries. The left cerebral hemisphere was softer than the right and on section a hemorrhagic infarct was found in its central portion.

Case II. A negress, aged twenty-four years, was shot in the face, the bullet notching the right mandible. The patient was admitted in shock but reacted favorably to stimulation and the administration of salt and acacia solutions. The following day there was marked swelling in the posterior pharyngeal wall and epiglottis and she had considerable obstruction to respiration. A tracheotomy was considered.

A roentgenogram showed the notch in the lower margin of the right mandible and the flattened bullet lying to the right and in front of the third cervical vertebra.

Five days after admission examination revealed a Horner's syndrome of the right eye. Ophthalmoscopic examination showed some pallor of the right fundus, but no other abnormality.

Thirteen days after admission examination revealed a left hemiplegia involving face, arm and leg, with hyperactive reflexes and an ankle clonus. A spinal puncture gave a clear fluid containing only 10 cells. The spinal fluid pressure was 13 cm. of water. The patient left the hospital eighteen days after admission with her condition practically unchanged.

COMMENT

The thrombosis in the first case was unquestionably due to a contusion of the internal carotid artery. Although the true diagnosis was made before death our first impression was that the symptoms and physical signs were due to a "head injury."

The real nature of the damage to the artery, undoubtedly the internal carotid, is not so certain in the second case. The delayed onset of the hemiplegia for thirteen days, together with the negative roentgenological and spinal fluid studies would indicate that the bullet had caused a contusion or laceration which was later followed by an extensive thrombosis. The diagnosis was not so difficult in this case because of the obvious injury to a large artery.

In both cases the posttraumatic thrombosis of the internal carotid artery resulted in a delayed but complete contralateral hemiplegia.

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CALCIFIED DEPOSITS IN SUBSCAPULARIS TENDON

REPORT OF A CASE

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DURING the past twenty-five years much has been learned concerning the pathology of painful lesions of the shoulder joint. As a result of the work of Codman, Carnett, Brickner and others, it is now well recognized that calcified deposits in the several tendons inserting about the shoulder joint are a frequent cause of pain in this region.

The tendon of the supraspinatus muscle is much the most frequently involved and it is such a lesion that is erroneously called subdeltoid or subacromial bursitis. Calcified deposits in the tendons of the infraspinatus and the teres minor muscles are not infrequent, but the presence of such deposits in the tendon of the subscapularis muscle appear to be distinctly rare.

CASE REPORT

T. B., male, aged fifty years, was first seen on May 20, 1935, complaining of pain and tenderness about the right shoulder. His past history was essentially negative except for a minor injury to the same shoulder received twenty years before while playing soccer. The patient was a dry cleaner by trade and actively engaged in this work until the onset of the present illness.

Twenty-four hours before reporting for examination, the patient was thrown into a pulley, striking his right shoulder. He immediately noticed pain in the right shoulder with associated tenderness over the anterior portion of the joint, but he continued to work during the remainder of the day. The pain however became progressively more severe during the next twenty-four hours and any motion of the shoulder caused distress.

On examination the patient was a well developed, well nourished, stocky individual suffering marked pain in the right shoulder. The temperature was 101°F., the pulse 90 and the respirations 22. The right forearm was supported by the left hand and every effort was made to limit all motion in the right shoulder joint. Positive physical findings were limited to this region. There was no asymmetry, atrophy or deformity in the region of the joint. On gentle palpation exquisite tenderness was elicited over the lesser tuberosity of the humerus, extending down the inner edge of the bicipital groove for a short distance. There was no tenderness over the greater tuberosity and no increased heat or discoloration of the skin noted. Flexion and extension of the forearm caused no discomfort but rotation of the humerus was extremely painful. Abduction of the arm also caused marked pain and was limited to approximately 45°. A tentative diagnosis of fracture of the lesser tuberosity of the humerus was made, but the usual anteroposterior and lateral *x*-ray plates taken were negative for fracture. The patient's forearm was placed in a sling and he was sent home with instructions to rest and apply heat locally for a period of twenty-four hours. At the end of this time the patient's temperature was normal but the pain had increased in intensity. Tenderness was even more marked and any rotation of the shoulder was resented. He was admitted to the Immanuel Hospital for further *x*-ray studies and treatment.

On the assumption that this might be a bursitis or a calcified tendonitis in the region of the lesser tuberosity, *x*-ray studies were made with the arm slightly rotated and abducted 90° to obtain better visualization of the lesser tuberosity. The films taken in this position are shown in Figure 1 and the report submitted by Dr. Tyler is as follows: "*X*-ray examination of the patient's right shoulder taken with the arm in the abducted position shows a calcium deposit in the region of the lesser tuberosity, interpreted as being a calcified bursa."

A clinical diagnosis of calcified tendonitis involving the tendon of the subscapularis muscle was made and the patient was treated conservatively for a period of five days. There was no improvement during this time and operation was decided upon in an effort to

relieve the patient's pain and permit him to return to his work at an early date.

Operation, May 30, 1935. Under open drop ether anesthesia, using a modified Lane technique an incision 6 cms. in length was made over the anterolateral aspect of the patient's right shoulder, extending down from the acromial process. The deltoid muscle was split and the greater tuberosity exposed. The tendons of the supraspinatus, infraspinatus and teres minor muscles were each carefully examined and seen to be normal. Rotating the arm outward, the lesser tuberosity was exposed. A definite yellowish-gray deposit, 1 cm. in diameter, was seen in the substance of the subscapularis tendon. This area was incised and a quantity of thick granular material simulating toothpaste escaped. This pocket was then thoroughly curetted, no effort being made to close the rent in the tendon. Further exploration disclosed an extension of the process downward along the inner edge of the bicipital groove, beneath the short head of the biceps. In this area about 1 cm. of similar white pasty material was found and removed. A small fragment of the tendon of the subscapularis adjacent to the calcified deposit was removed for section and a culture was taken. The wound was closed in layers and the arm loosely bound to the side for a period of twenty-four hours.

Pathological Report. The material removed for culture was sterile. Microscopic examination of the tissue removed for section showed edematous connective tissue, in which there were large numbers of mononuclear cells and diffusely distributed polymorphonuclear cells.

Diagnosis. Acute and subacute inflammation.

Twenty-four hours after the operation the patient's pain was entirely relieved and he made a rapid and uneventful recovery. One week after operation he could abduct his arm 90° without pain and rotation was accomplished without the least discomfort. He returned to his work one month following operation and has continued without pain, weakness or limitation of motion in the six months that have elapsed since that time.

DISCUSSION

The tendon of the subscapularis muscle appears to be a very unusual site for the deposition of calcified deposits causing acute shoulder pain. In a careful review of the literature covering the past twenty years only 2 such cases have been found.

Fig. 1. Film of the upper right humerus with the arm in the abducted position. Note calcified deposit overlying the lesser tuberosity.

Both of these were reported by Codman in a personal series of 970 lesions of the shoulder joint, of which 135 patients suffered with calcified tendonitis.

That the tendon of the subscapularis should be involved much less frequently than the supraspinatus, infraspinatus and the teres minor is readily understood from an anatomical standpoint. However an adequate explanation for the development of the pathological process in our patient is as difficult to suggest as in the more frequent case in which the tendon of the supraspinatus is affected.

Acute and chronic trauma to the shoulder, occupation, working with the arms in the abducted position, focal infection and abnormal calcium metabolism have all been suggested as factors predisposing to the development of painful calcified tendonitis. Typists, file clerks, chauffeurs and physicians constitute more than a normal percentage of patients suffering from this condition. It seems quite logical to suspect that prolonged hours of work with the arms abducted, may place undue stress

upon the tendons about the shoulder joint and predispose to pathological changes. This patient has for years operated a pressing machine which necessitates working for hours with the arms abducted 90° from the body.

There can be little doubt that the calcified deposits were present in the involved tendon prior to the acute trauma which caused the patient to seek medical advise. The frequency with which painless calcium deposits about the shoulder joint are seen by the roentgenologist in the course of examinations for other causes, is good evidence that many of these lesions may go for years without causing any trouble. That varying degrees of trauma to such deposits may promptly result in acute symptoms is also well appreciated. This patient undoubtedly is an example of such a sequence of events.

Little difficulty is encountered in demonstrating on the *x*-ray plate calcified deposits present in the tendons inserting into the greater tuberosity of the humerus. However, when such collections occur in the subscapularis tendon, as in this case, they may be very easily overlooked in the usual anteroposterior and lateral views taken. If the deposit is recent, it may cast only a faint shadow on the film, and overlying the head of the humerus, be readily missed. Placing the film in such a position that the lesser tuberosity is seen in profile readily obviates the possibility of missing such a deposit, should it be present. One wonders if cases of pain about the shoulder joint due to calcification in the tendon of the subscapularis muscles are not infrequently undiagnosed when studied in the usual manner by *x*-ray.

Bed rest, morphine for pain, gradually carrying the arm into the abducted position by traction, heat or cold locally, injections of quinine and urea and diathermy have all been suggested in the conservative treatment of these lesions. Codman is the authority for the statement that, in his experience, all cases of calcified tendonitis, whether treated or not, eventually recover without any permanent complications of any kind. "Recovery is only a matter of time." One may in all honesty assure the patient that the calcified deposit will in all probability disappear spontaneously in a period of several months. Should the deposit chance to rupture into an adjacent bursa, permanent relief will probably follow in a few weeks time.

In most instances, however, the economic factor must be considered and many patients suffering from the acute pain incident to a calcified tendonitis are either unable or unwilling to devote the time necessary to treatment by conservative measures. To this group of individuals surgery may be offered as a prompt and safe way of relieving their pain and permitting their early return to work with little chance of recurrence.

SUMMARY

A case of acute shoulder pain incident to the presence of calcified deposits in the tendon of the subscapularis muscles is reported. Only 2 similar cases have been found in the literature covering the past twenty years. Surgical removal of the deposit resulted in the prompt relief of pain and complete return of function.

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METASTATIC TUMORS OF HEART

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METASTASES of malignant tumors to the heart are somewhat more common than primary growths of this organ. Mead,[1] from the literature, found an incidence of 0.5 per cent in general autopsies and a frequency of 3.1 to 7.5 per cent amongst malignant necropsies. Practically any organ of the body in which a malignant growth may arise, may be the primary site from which metastases disseminate to the heart. Morris'[2] and Goldstein's[3] extensive reviews record cardiac colonies from tumors of the traches, tongue, breast, submaxillary glands, eye, nasal passages, thyroid,[4] eosophagus, stomach, pancreas, liver, kidney,[5] uterus, testis, labia, lungs,[6] lymph glands and skin.

Of those tumors metastasizing to the heart, bronchiogenic cancer is probably the most frequent offender. The continuity and contiguity of thoracic structures may account for this incidence. Again, the role played by the lungs in the cardiovascular cycle suggests another reasonable explanation. Adler,[7] in a series of 374 cases of pulmonary malignancy, found 39 cases with metastases to the pericardium of which 30 invaded the heart proper. Simpson's[8] group of 139 cases revealed 62 instances of pericardial involvement but none encroached on the heart itself. Kikuth[9] observed myocardial colonies in 4 of his 240 recorded cases. Miller and Jones,[10] summarizing 808 cases of primary pulmonary neoplasms, found metastases to the pericardium and heart in 2.7 per cent of the cases; Burke[11] lists 14 cases of secondary colonies in the heart, a frequency of 4.3 per cent, in 327 malignant necropsies.

Lymphatic conduction accounts for a limited number of metastases to the heart. Through the tracheobronchial glands which drain pleura, lungs, and contents of the pericardial sac a retrograde invasion may occur from the lung to the heart. Kapsinow[12] cites his case of carcinoma of the breast in which direct lymphatic infiltration to the heart could be traced.

Direct extension is possible, but Morris[2] states that the heart is seldom involved by direct continuity from neighboring organs and Mead's[1] summary of a large series substantiates this view.

Generally, cardiac metastases are believed to be blood borne. Fried[13] found tumor cells invariably present in the lumen and walls of blood vessels of every organ studied for its metastases. This constancy supports a premise of hematogenous dissemination. Tumor cells in the blood stream, mural and valvular thrombi of cancer cells, small bits of tumors in blood clots and strands of carcinomatous cells in the coronaries add further proof. It is commonly believed that the pulmonary veins act as a route over which the tumors cells are not only conveyed, but act as a road bed along which direct extension may occur.[1] In a like manner, the vena cava has served.[1,4,14] The great vessels to the heart form an important route of direct extension. Hematogenous dissemination infers the establishment of the secondary colonies within the heart chambers and their contents. Such is generally the case. However, small cellular emboli may escape such a fate, and instead finally lodge in the terminal branches of the coronaries, forming intramural tumors. Such infrequent[9] but possible colonization has prompted the report of the following observed case.

CLINICAL HISTORY

E. P., a white male dyer, forty-seven years old, was admitted January 14, 1935 complaining of fatiguibility, productive cough, dyspnea,

chills and fever and a weight loss of 18 pounds since the onset, November, 1934. Physical examination revealed emaciation, clubbing of fingers, dimunition of breath sounds throughout both lung fields, bronchial breathing and coarse rales in the right base and liver palpable 5 cm. below the costal margin. The cardiovascular system appeared within normal range.

On January 16 *x*-ray examination of the chest showed initially a diffuse mottling of the right lung field, followed by an atelectasis on January 29. A postmortem film taken February 3 showed an interlobar empyema between the right middle and lower lobes.

The sputum was persistently negative for acid fast organisms. The blood sedimentation rate was 45 mm. in the first hour and 57 in two hours, leucocytes 15,000 with 77 per cent neutrophiles.

The patient ran a septic temperature and expectorated from 90 to 130 grams a day.

AUTOPSY FINDINGS

Lungs (Fig. 2). The right lung showed diffuse miliary abscesses of the upper and lower lobes, associated with a bronchiectasis. Between the middle and lower lobes was an empyema cavity of 75 to 100 c.c. capacity. On opening the right bronchus, the wall especially superiorly, was thickened 1.5 to 2 cm. The mass occurred just beyond the tracheal bifurcation and surrounded the primary branches of the bronchus. It was cartilagenous in consistency and grey in color. The border infiltrated indistinctly into the parenchyma. The left lung showed a moderate passive congestion.

Heart (Fig. 1). In the anterior portion of the right auricular wall was a small sharply demarcated grey nodule, 1 cm. in diameter, and the left auricular appendage presented a similar nodule. Two nodules, 3 mm. in diameter, were found in the wall of the left ventricle

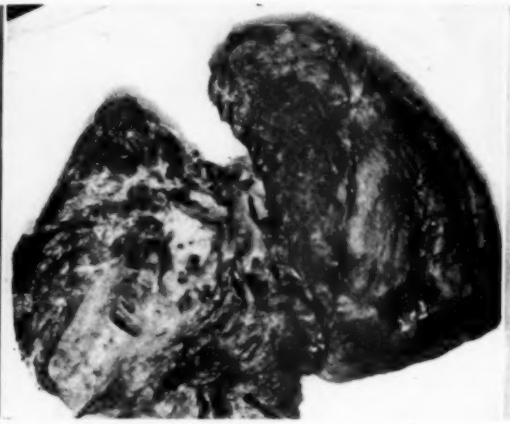
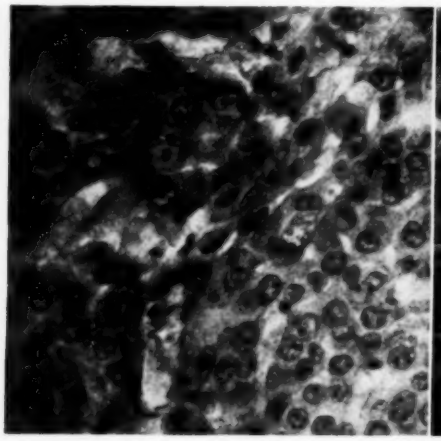


Fig 1. Fig. 2. Fig. 3.

Fig. 1. Heart showing metastatic nodules.
Fig. 2. Lung showing central white area of tumor mass and the interlobal empyema.
Fig. 3. Kidney showing adrenal metastasis.



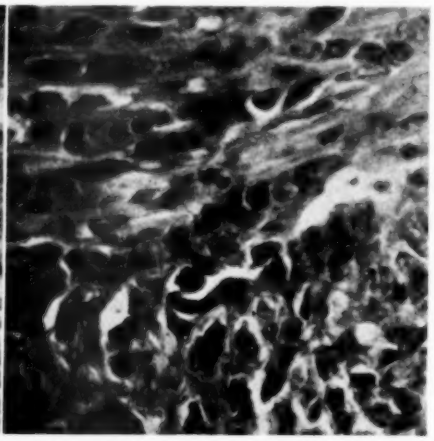


Fig. 4. High power of primary tumor in the lung.

Fig. 5. High power of metastatic nodule in the heart.

just beneath the pericardium, anteriorly. No other tumor tissue was found in the heart or coronary vessels.

Secondary colonies were observed in the superior pole of the right kidney, the right adrenal and the mediastinal lymph nodes (Fig. 3).

Microscopic examination showed the primary tumor to be a bronchiogenic carcinoma, Epidermoid, Grade II, R.R. In places it showed considerable polymorphism and the metastatic lesions displayed a greater degree of anaplasia than the primary focus (Figs. 4 and 5). The myocardial colonies showed a complete ring of peripheral muscle fibers with an intact endocardium and pericardium, denying an invasion either from the pericardium or the heart chamber.

DISCUSSION

The interesting feature of this case lies in the secondary colonies in the heart. Their dissemination is obviously hematogenous. Since both the large vessels to the heart, the heart chambers, the pericardial sac and the coronary vessels were free of any tumor tissue, it is probable that the tumor cells circulating in the blood stream found their way into the terminal branches of the coronaries and lodged in the myocardium setting up metastases.

SUMMARY

A case of bronchiogenic carcinoma of the main bronchus is observed in which there were cardiac metastases whose isolated nature suggests dissemination by blood borne cellular emboli.

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TRAUMATIC RHABDOMYOSARCOMA OF THIGH*

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RHABDOMYOSARCOMA is a lesion of very uncommon occurrence. Skeletal muscle involvement is extremely rare and very few authentic cases with autopsy findings are reported in the literature. Up to 1913 Burgess[1] did not find a single case recorded, when he reported a case of rhabdomyosarcoma of the thigh with multiple metastasis in a girl of nineteen years. Muller[2] in 1917 reported a case of traumatic rhabdomyosarcoma of the thigh following successive fractures of the femur. In 1927 Wagner[3] reported a case occurring in the buttock. A year later Wolbach[4] reported a case of malignant rhabdomyoma of the spinal muscles at the region of the fifth and sixth dorsal vertebras. In 1929 one case reported by Hirsch[5] occurred in the leg with metastasis to the lungs, and another case was reported by Jeanneney[6] occurring in the quadriceps muscle. Two cases were reported by Singleton and Hyde[7] in 1931, both occurring in the left thigh. MacCallum[8] reported 2 cases in 1932, one occurring in the arm with suggestive metastasis to the lungs and the other in the calf of the leg. This totals 10 cases reported since 1913.

FIG. 1. Cauliflower growth of rhabdomyosarcoma.

In reviewing the literature of rhabdomyosarcoma of skeletal muscle, one is impressed by the numerous operations to which each case was subjected, and the numerous recurrences, finally ending in amputation of the limb, followed by metastasis and death. The conservative multiple surgery instead of radical excision may perhaps be explained by the great confusion existing in reporting these tumors, and the difficulty encountered in recognizing them. This difficulty is well illustrated by MacCallum, who states, "Since the criterion frequently demanded before an origin from muscular tissue will be admitted is the demonstration of the characteristic cross striations, it is not at all improbable, indeed it is almost certain, that many tumours truly of such origin or character are not recognized as such, and are relegated to the tumour scrap-heap of sarcoma," therefore this "scrap-heap of

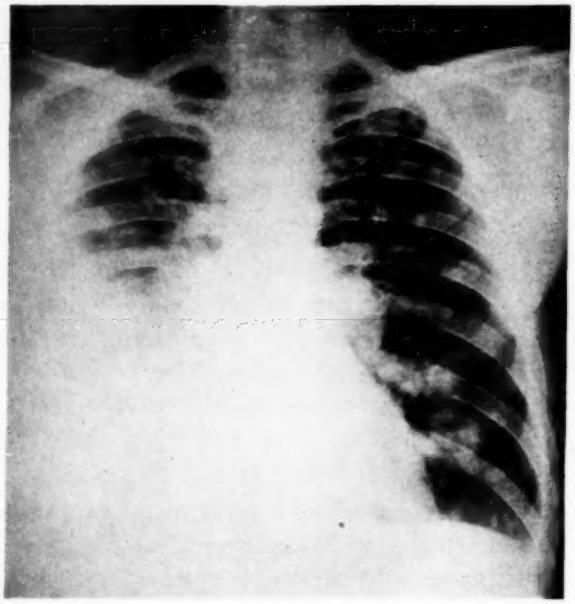

FIG. 2. Rhabdomyosarcoma metastasized to the lungs.

* From the Brooklyn Cancer Institute, Dr. Ira I. Kaplan, Director.

sarcoma" contains a multitude of tumors. Not only the lack of cross striations makes the origin of this type of tumor difficult, but the preponderance of spindle type of cells, round cells and the presence of fibroblasts, which makes it appear truly a fibrosarcoma. MacCallum concludes that mixed spindle and round cell sarcoma occurring in any tissue calls for critical examination if we are to mitigate the ignorance that induces us to seek refuge in such narcotic nomenclature.

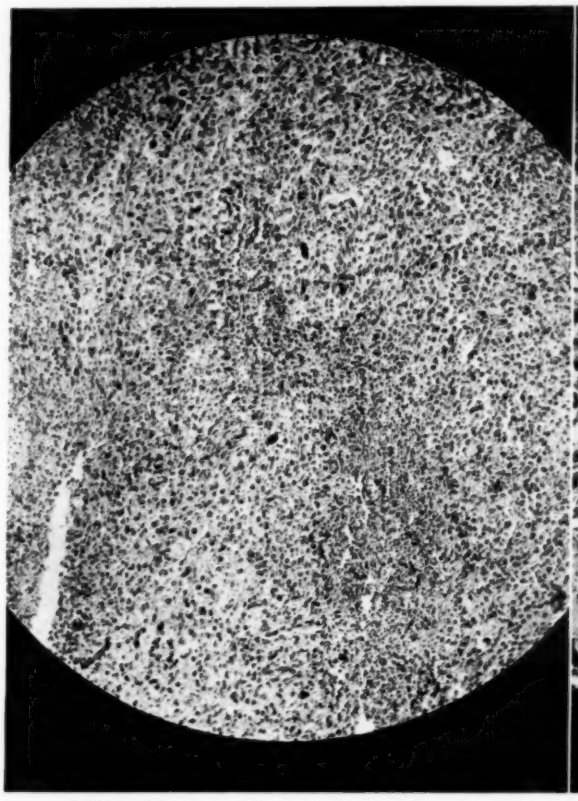

Fig. 3. Microphotograph under low power showing rhabdomyosarcoma of the thigh.

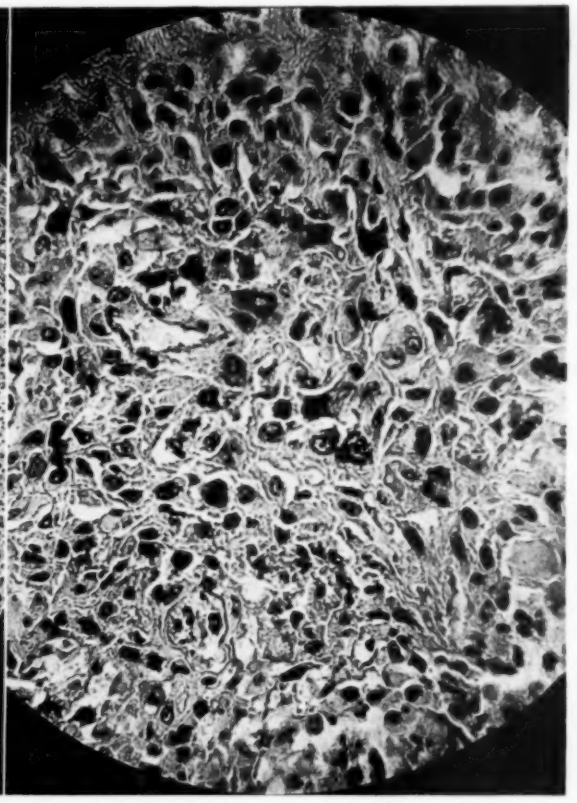

Fig. 4. Microphotograph under high power showing rhabdomyosarcoma of the thigh.

CASE REPORT

A white adult male, aged forty-four years, was admitted to the Brooklyn Cancer Institute on May 7, 1935, complaining of pain and swelling of the left thigh. About a year previously he had fallen and struck his left thigh, a week later a blue, nontender lump appeared at the site of the injury, which grew progressively larger until it reached the size of a grapefruit. About six months later the tumor became very painful, and he was admitted to a hospital, where the tumor was excised. However, the wound never healed and began to ulcerate. He received *x*-ray therapy without any improvement and was then referred to this institution for further advice and treatment.

As a child he had measles and scarlet fever. At the age of fourteen years he had malaria and shortly afterwards he contracted gonorrhea. There was no other history of disease. His family history was essentially negative.

Physical examination revealed a white adult male, poorly nourished, anemic, with a Hippocratic facies, weighing 134 pounds, 5 feet 8 inches in height, moaning with pain, temperature 102.8°F., pulse 118, respiration 22, blood pressure 102/60. The anterior aspect of the left thigh presented an ulcerated, necrotic cauliflower mass, which bled very easily upon manipulation, measuring 7×4 inches, with induration and swelling of the surrounding tissues. Glands were found in the left inguinal region, the size of a hazelnut, firm and freely movable. Examination of the chest revealed evidence of fluid in the right base with scattered areas of dullness and loss of breath sounds

bilaterally. The rest of the physical examination did not yield any pathologic findings.

The urine examination showed no abnormality. The blood Wassermann was negative. The blood count revealed 22,000 white cells with 89 per cent polymorphonuclears, 10 per cent lymphocytes and 1 per cent eosinophiles. The red count was 2,800,000 with hemoglobin of 55 per cent. Roentgen ray examination of the chest revealed an effusion in the right pleural cavity with numerous circumscribed metastatic foci throughout the right and left lung fields. Roentgenogram of the left femur did not show any bone pathology.

On May 22 a thoracocentesis was performed on the right chest and 1200 c.c. bloody fluid was removed. A radium pack was applied to the leg, consisting of six radon platinum tubes containing 256 m. c. radium emanations at 6 cm. distance. The patient received a total of 27,265 m. c. hours. However, he became progressively worse, his temperature rose to 105°F., he became very dyspneic, and he died May 26.

An autopsy was performed. The final diagnosis was reported by Dr. S. H. Polayes, pathologist, as:

1. Rhabdomyosarcoma of the left thigh with metastasis to the lungs, pleura, pericardium, liver, kidneys, and inguinal, tracheal and aortic lymph nodes, skin.
2. Serosanguineous pleural effusion.
3. Chronic purulent pericarditis.
4. Toxic splenitis.
5. Purulent bronchitis.
6. Bronchopneumonia.
7. Renal cloudy swelling and congestion.
8. Multiple visceral thromboses.

COMMENT

This case is of interest not only because of the rarity of the tumor, but also its association with direct trauma. Ewing[9] states that "Sarcoma commonly develops after a single blow." A history of trauma in similar tumors is reported by Muller in 1917 and Hirsch in 1929. Coley[10] reported 26 cases of traumatic soft tissue sarcoma in 1889. This is another case of definite rhabdomyosarcoma occurring on the site of a distinct trauma to the thigh.

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PERIPHERAL VASCULAR DISEASE WITH GANGRENE OF EXTREMITIES

CASE REPORT

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THE following case is reported to show some interesting pathological features associated with peripheral vascular disease.

W. B., white female child, aged four and one-half years, was seen October 10, 1934, being referred for treatment of a gangrenous condition of the right foot and fingers of both hands. According to the history, the condition was first noticed at six to eight weeks of age. She used to bite the ends of her fingers, which apparently had no sensation. The ulcerated ends of the fingers refused to heal and gradually the trophic process involved most of the fingers of both hands. On one occasion, at the age of two years, she intentionally cut the skin of the palms and fingers of both hands with a razor, without feeling any pain. The skin of the extremities and face has always been very slow to heal, even with minor abrasions.

About a year ago she accidentally cut the big toe of her right foot by stepping on a piece of broken glass. Although the wound was trivial, a gangrenous process developed and gradually extending until it included the two phalanges of the big toe and the head of the first metatarsal bone, together with the soft tissues.

The patient's mother was living and well. Her father was living, but had had a positive Wassermann and had received antileutic treatment. The patient also had antiluetic treatment about two years previously.

Examination. In general appearance the patient showed a definite mental retardation and was moderately anemic. An interstitial keratitis was present in both eyes, more prominent on the right; the outline of the pupils could not be seen. Vision undoubtedly was present but in looking at close objects she would turn her head and look out of the corner of her eyes. Hearing was not impaired. She had an ulceration of the septum of her nose, involving the cartilaginous portion. Her tonsils were cryptic. She had a marked speech defect and was constantly drooling saliva.

The knee jerk was absent on the right. The right inguinal lymph nodes were moderately enlarged but not painful. The patient could walk without difficulty and coordination of movements was very little impaired. The right big toe was amputated at about the level of the metatarsophalangeal joint. At the site of the amputation was a gaping wound, whose margins were covered with a grayish necrotic tissue with very little bleeding on scraping the wound. There was no attempt at granulation tissue formation and the entire wound seemed avascular. The skin of the feet, legs and thighs showed a mottled bluish discoloration, which became more marked when the extremities were dependent and disappeared slowly on elevation. The pulse of the dorsalis pedis and posterior tibial arteries could not be palpated in either foot. The skin of the feet and legs was cold and moist with no sensation of pain evoked on pinching or on deep pressure. In the right leg and foot, the skin and subcutaneous tissues had a firm rubbery feel. Several ulcerated areas in the skin of the leg just below the knee resulted from small abrasions produced a number of weeks previously which spread subsequently and failed to heal (Fig. 1).

In the hands, the thumbs and most of the fingers had lost the terminal phalanges due to gangrene and the skin and subcutaneous tissues were swollen so that very little motion in the fingers was present. The skin of the ends of the fingers had a pale marble-like appearance. In the arm and forearm the skin had the same mottled appearance as the lower extremities, though less marked. No sensation of pain was elicited. As in the lower extremities, the skin of the hands, forearms and arms was abnormally cold and moist.

The skin of the face was pale, more uniform in color and sensation was definitely diminished.

Examination of the urine was negative.

Blood examination showed hemoglobin, 65 per cent; erythrocytes, 4,770,000; leucocytes, 14,950; differential, normal.

Fig. 1. Photograph showing condition of patient on admission.

The Kolmer and Kahn tests were negative.

The patient was admitted to the hospital on October 25, 1934. During a period of observation of one week, no change was noted in the patient's condition, in spite of attempts at local treatment. As a method of testing the circulation in the lower extremities, the patient was placed in a bathtub of water, immersing the feet, legs and thighs. In raising the temperature of the water, it was found that at 40°C., the skin of the lower extremities assumed a uniform pink color and at that stage sensation of the skin was definitely present.

From an analysis of the condition, it was obvious that a deficiency of the peripheral vessels was responsible for it. A vasospasm of the larger vessels, produced by overactivity of the sympathetic nervous system, was considered most probable as the underlying cause.

In deciding on the method of treatment which was instituted, the following points were considered: (1) the conception of Telford and Stopford[1] that vascular changes can be produced as a result of stimulation of the sympathetic nerves by mechanical influences; (2) the views of Oughterson, Harvey and Richter[2] that vasomotor innervation is supplemented by a source of nerve supply, other than that from the lower thoracic and upper lumbar nerves; and (3) the writer's belief in the possibility of abnormal structures such as occur in association with spina bifida occulta.[3] Success in the treatment was dependent on the presence of harmful influences within the spinal canal, and so arranged that injurious effects would be produced by irritation of the vasomotor nerves supplying the vessels of the lower extremities. The form of pathological change, which was considered most probable, consists of the presence of a mass of fat and fibrous tissue in close relationship to the nerve roots, with or without spinal clefts. It should be stated in this connection, that no spinal defects were found on *x*-ray examination of the lumbosacral and the cervicodorsal regions.

On November 2, 1934, the following operation was performed; under avertin-ether anesthesia, a midline incision was made over the lumbosacral region, reflecting the muscles to expose the upper portion of the sacrum. No bony abnormalities were found. The spinous processes, together with a portion of the lamina were removed from the first and second sacral segments. The dural sac was seen to pulsate normally at the level of the first sacral segment. The lower end of the dural sac, which was situated at the junction of the first and second sacral segments, was completely enveloped by a mass of grayish tissue which had the appearance of being mostly fat and had no visible connection with any of the bony structures of the canal. It occupied the level of the second and part of the first sacral segments and was not compressed by the bony canal. In attempting to remove it with instruments, it was found to be very friable. Several of the larger nerve roots were seen to be coursing through this mass of tissue, being completely enveloped by it at that level. At this stage of the operation, and before dissection could be completed, the patient's respiration ceased. After being revived, it was considered advisable to discontinue the dissection and the wound was closed.

A small particle of the tissue was examined by Dr. C. A. Hellwig, who reported as follows: On microscopic examination the tissue consists of fat and fibrous tissue which show

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[2] Oughterson, A. W., Harvey, S. C. and Richter, H. G. Observations on sympathetic vasomotor pathways. *Ann. Surg.*, 744 (Oct.) 1932.

[3] Dittrich, R. J. Lumbosacral spina bifida occulta, *Surg., Gynec. and Obst.*, 53: 378, 1931.

infiltration with leucocytes and extensive hemorrhage (Fig. 2).

Recovery from the operation was favorable.

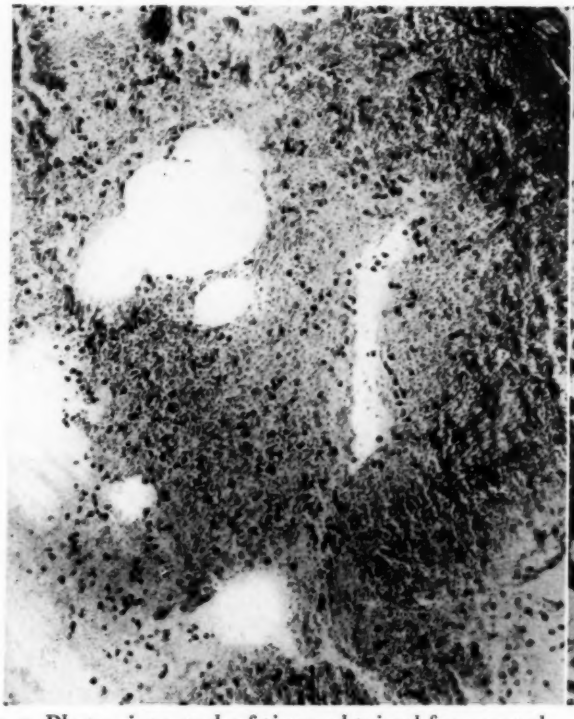

Fig. 2. Photomicrograph of tissue obtained from sacral spinal canal.

Fig. 3. Photomicrograph of tissue obtained from spinal canal at cervicodorsal level.

The patient had involuntary urination and defecation for a period of ten days. The wound healed by primary union.

Immediately following operation a change was noted in the circulatory condition of the lower extremities. The skin had assumed a normal pink color and was warm and dry, ulcerations in the skin bled easily and freely. Although these changes were for the first few days attributed to the general reaction following operation, further observation showed them to be more permanent. Ten days after operation, several ulcerated areas which were present on the right leg for a number of weeks, had healed. Four weeks after operation, the gangrenous area at the site of the right big toe, was completely healed. During that time several small sequestra were extruded from the wound. Seven weeks after operation, the fingers were practically healed due apparently to local treatment. There was also a diminution of the swelling of the fingers, allowing better function.

The patient was dismissed from the hospital on December 18, 1934 and returned three weeks later. While at home, there was a recurrence of the gangrenous process of the fingers, partly as the result of a slight burn. The hands and fingers were pale, indurated and deficient in circulation, as seen from the refusal of tissues to heal normally and from the absence of normal bleeding. The lower extremities had retained a normal appearance in color and temperature.

Kolmer and Kahn tests at this time were again negative.

It was considered quite probable from these observations, that a pathological lesion, similar to that found in the sacral spinal canal was present at a higher level, to produce the disturbance in the upper extremities. With this type of condition in mind, an operation was undertaken on January 25, 1935. An incision was made over the spinous processes from the sixth cervical to the third dorsal vertebra, reflecting the muscles. The spinous processes and portions of the lamina of the seventh cervical and first and second dorsal vertebra were removed. The dura was found to be covered with a thin layer of soft reddish gray, very friable tissue, loosely attached to the dura. This tissue could be stripped off easily and was very vascular. The layer of tissue, evidently fat

and fibrous tissue, did not seem to extend ventrally but covered only the dorsal half of the dural sac. It was not under pressure from the bony canal. In thickness it varied from 1 to 3 mm. It covered the dura at the level of the first and second dorsal segments and possibly extended distally farther than the level explored. In removing this mass considerable diffuse hemorrhage was encountered but this was easily controlled. The muscle, fascia and skin were sutured in layers.

The pathological findings were reported by Dr. C. A. Hellwig as follows: "Grossly the specimens consist of fat and fibrous tissue, and several areas are hemorrhagic. Microscopically, most of the specimen consists of fatty tissue which is invaded by fibrous strands. The blood vessels do not show pathological changes. There is no proliferation of the intima. In one area a well formed piece of hyaline cartilage is found, in other areas a few deposits of amorphous lime material are noticed. Fresh hemorrhages are present in large areas."

Recovery from the operation was favorable. A superficial necrosis of a portion of the incision developed but this healed promptly. The upper extremities assumed a normal appearance in color and temperature. The condition of the fingers improved so that in four weeks all ulcerations had disappeared. At that time she was discharged from the hospital.

The patient was seen at intervals and had remained free from any of the previous disturbances for approximately six months.

When she was seen on July 21, 1935, she had just recovered from a short but severe attack of whooping cough. About a week previously the left index finger again became ulcerated, and there was also a recurrence of the gangrenous process of the right big toe. There was at this time a definite improvement of the condition of her eyes.

On examination December 7, 1935, a mild recurrence of the discoloration was seen in the lower extremities. The skin was warm and dry. The wound at the site of the amputation of the big toe was still open. On *x*-ray examination of the right foot it was found that the upper half of the first metatarsal was present and the lower end of this bone was necrotic. The pulse of the dorsalis pedis artery could not be palpated in either foot. The pulse of the posterior tibial artery was palpable in both feet. The interstitial keratitis previously seen in the left eye had entirely disappeared, and in the right eye it was diminished in size. The pupils were clearly visible in each eye and responded to light and accommodation. The hands showed several open wounds which were situated in the creases of the fingers.

On February 7, 1936, the gangrenous area of the right foot was again healed. The skin of the lower extremities was warm, dry, bright pink in color and had very much a normal appearance. An abrasion of the right leg, caused by an injury, showed evidence of rapid healing. The skin of the arms and forearms was normal in appearance. The hands and fingers showed no ulcerations. A mild return of the keratitis was noted in the left eye. The skin of the face in its reaction to injury, indicated a normal circulation.

COMMENT

In reviewing this case, the outstanding features are the pathological operative findings and the improvement which followed the operative treatment. The masses of fat and fibrous tissue are structures which have been described by numerous writers and are thought to be associated with spina bifida occulta. The most reasonable explanation for the occurrence of such masses is that of von Recklinghausen, who states that they are the result of a transposition of tissue during early embryonic life.

The improvement manifested by the rapid healing of the wounds in the leg and foot and by a more normal circulation, is attributed to the operation which, though incomplete, relieved the pressure on the nerves at that level. In the sacral region the abnormal tissue mass consisted mostly of fibrous tissue, with only small amounts of fat. There was evidence of inflammation and hemorrhage, and it is very likely that the soft tissue lesion was the site of a progressive change from fat to fibrous tissue. This would be expected to produce a gradual strangulation of the affected nerves.

In the cervicodorsal region the relationship of the pathological findings to the circulatory disturbance of the hands and face was not so clear. The mass of tissue

covering the dura was not seen to be in any direct contact with the nerve roots, nor was it possible to ascribe to it any pressure produced on the cord. The post-operative improvement in the condition of the upper extremities, though not as prompt as it was in the lower extremities, was such that it may be safely considered the result of removing a disturbing factor by the operation. The same factor was undoubtedly also responsible for the trophic disturbance of the face. The sympathetic nerves from the upper dorsal level of the cord constitute the only structure which has common connections with both of these regions. Therefore it seems likely that an irritation of the sympathetic nerves was responsible for the vasomotor dysfunction of the upper extremities and the face.

In conclusion it is obvious, from observations in this case, that the vasomotor disturbance can be ascribed to clear cut pathological structures, which can be removed by operation. The result was sufficiently satisfactory to justify further application of the therapeutic principles which were employed.

SUMMARY

The condition described in this case is evidently a vasospastic disturbance of the peripheral circulation. The treatment employed consisted of laminectomies in the lumbosacral and the cervicodorsal regions and the removal at both levels, of masses of fat and fibrous tissue, situated in the spinal canal. The immediate result of the operations was an improvement in the circulatory condition of the extremities, with a rapid healing of the gangrenous areas. With the exception of a brief recurrence of the vascular dysfunction, the result at the end of one year is very satisfactory.

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* *Continued from p. 526.*

ACUTE EDEMA OF VULVA

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EDEMA of the vulva is not uncommon as part of a generalized edema associated with the late toxemia of pregnancy. However, an acute and selective swelling of the vulva in the absence of any marked peripheral edema is unusual. Its noteworthiness is evidenced by (1) the fact that in over 4000 full term pregnancies in the King County Hospital only 2 cases have been noted; and (2) the fact that there was a marked divergence of opinion as to the best manner of treatment of the condition, since it pointed to a very possible complication of labor.

Reports of this condition are relatively scarce in the medical literature, during the past twenty years approximately 15 cases being recorded. Hoehne, in Germany, discussed 5 cases about ten years ago, while Schmid considered it from the standpoint of an indication for caesarian section. Greenhill and Gertler, both writing in Germany, discussed the possible indications for caesarian section in edema of the vulva. Williams, in the American literature, presents an excellent illustration of a woman with unilateral edema of the labium.

Aside from its collaborative evidence as to the presence of a toxemia, acute edema of the vulva has no special significance. Dystocia is not likely despite the turgescence of the parts. Definite reduction of the swelling in the tissues is imperative, however, in obviating the possibility of laceration and hemorrhage.

Drainage of the fluid by either aspiration or stab wound at the most dependent portion of the labium is sufficient to eliminate the remote possibility of dystocia and the real danger of serious laceration. Drainage of vulvar edema seems to produce a favorable effect upon cervical edema should it be present, particularly if contractions are regular and strong but intervention is best postponed until preparations are completed for termination of the second stage of labor.

The etiologic background of such a selective edema is obscure. One of the 2 cases reported presented the classic pre-eclamptic syndrome, while the other case was associated with mitral stenosis and cardiac decompensation but revealed no symptom complex of toxemia. Obviously the increased cell permeability characteristic of the late toxemias of pregnancy contributes its share toward the appearance of such a local condition. The real local selectivity may be attributed to the normal increased congestion of the pelvic structures during pregnancy. Passive congestion of the pelvic organs is recognized as occurring in pregnancy where cardiac disease of decompensatory degree is associated.

CASE REPORTS

CASE 1. Mrs. E. V., age twenty years primipara, gravida ii, was hospitalized on June 13, 1934, for management of pregnancy at term complicated by an acute edema of the labia majora and minora. Her sole complaint on admission was a sensation of painful stretching in the external genitalia. She was not in labor.

The patient's history was negative except for an uncomplicated appendectomy in childhood and a normal pregnancy and delivery in 1932.

Her present illness began in April, 1934 with a gradual slight swelling of the ankles. She asserted that during April and May she gained fifty pounds in weight and occasionally noted headache, dizziness, diplopia and photophobia. According to a physician consulted during this period there was no albuminuria. On June 10, however, albuminuria appeared and she observed a sudden swelling of the labia.

On admission to the hospital three days later, the patient presented no evidence of acute illness. She was well nourished and

Fig. 1. Case I.

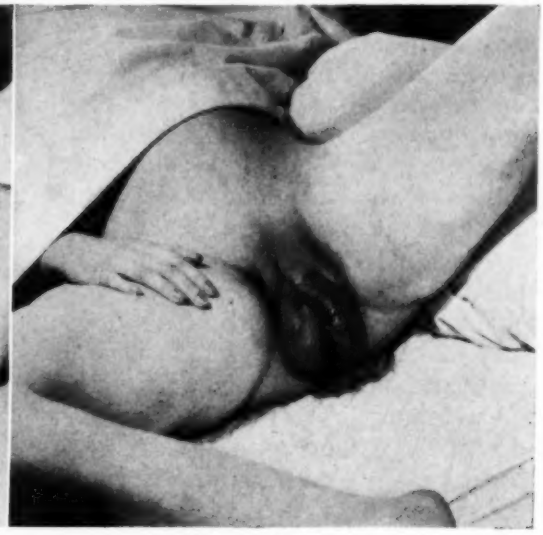

Fig. 2. Case II.

Figs. 1 and 2. Acute edema of vulva.

without marked generalized edema. General examination demonstrated a full term pregnancy with the occiput presenting and engaged. There was no edema of the abdominal wall, nor any ascites. Rectal examination revealed a short, soft cervix with 2 cm. dilatation.

The blood pressure was 170/105, the pulse 108; temperature 99.2°F. and respirations 20. The urine showed an alkaline reaction, specific gravity 1.021, albumin 21 per cent by volume, no sugar and microscopically a moderate number of hyaline casts and an occasional pus cell.

Conservative treatment was instituted for the toxemia. On the second hospital day the patient's blood pressure had increased to 180/120, the urine remained the same but the labial edema was much increased.

Induction of labor with castor oil and quinine was instituted on the second morning. Seventeen hours later mild labor pains were noted and three hours and fifty minutes after her first contraction a male infant weighing six pounds, seven and one-half ounces, was delivered spontaneously. The accompanying photograph was taken about one hour prior to delivery. (Fig. 1.)

During the course of delivery there was a slight mucous tear in each labia minora through which the fluid drained rapidly from both labia majora and minora. As no other laceration was present no repair was necessary. The third stage was terminated spontaneously and promptly. Upon return to bed the patient's condition was comparatively satisfactory though her blood pressure was 170/120.

Her discharge from the hospital was on the eighth postpartum day after an uneventful puerperium, her blood pressure was 120/90, there was no dependent edema, the urine had cleared satisfactorily and the labia were entirely normal.

Case II. Mrs. M. T., age twenty years, primipara, gravida 1, entered the hospital on June 28, 1934 complaining of an uncomfortable swelling of the external genitalia. No other distressing symptoms were noted except dyspnea which she had suffered for two years.

The vulvar swelling appeared abruptly one morning about two weeks prior to admission and became progressively worse in spite of rest in bed at home and limitation of fluids. Three weeks before hospitalization the patient's ankles began to swell slightly. No headaches, dizziness or occular symptoms had been experienced.

In the past history nothing pertinent to the present illness was found. Two years previously she had had pneumonia. Since then the dyspnea and a non-productive cough had made their appearance.

Examination of this patient revealed a pale, well nourished female with abdomen enlarged to slightly above the umbilicus. Moderate

dyspnea was present as she lay in bed. Respirations were 30; the pulse was regular and rapid; the blood pressure was 150/90; the temperature was normal. There were moist rales at the base of both lungs, the heart was enlarged and revealed definite mitral stenosis.

A very moderate pitting edema limited to the ankles was noted. The photograph (Fig. 2) is misleading on this point due to distortion from the proximity of the feet and the camera. Massive edema of the labia minora was present, but relatively little swelling of the labia majora accompanied this. Both labia minora were approximately $8 \times 10 \times 12$ cm. This edema was not as marked as in Case 1, but the patient was obviously quite uncomfortable both at rest and during movement of the legs.

Laboratory analysis revealed no significant disturbances of the renal function.

This patient was placed on restricted fluids and routine antepartum care, while her cardiac condition was managed by the internist. The day following her admission spontaneous labor began and progressed. When the cervix was fully dilated she was prepared for delivery. Each labium minora was aspirated with a short, large bore needle and 450 c.c. of clear fluid obtained. Spontaneous delivery of a premature, though well developed, infant followed.

The postpartum course was uneventful and the patient was later transferred to the medical service for further treatment of her cardiac condition.

CONCLUSIONS

Two cases of acute vulvar edema are presented in pregnant women at term

The condition is unusual and its management may therefore easily perplex the average practitioner when confronted with such an edema.

Laceration and consequent serious hemorrhage may arise if timely reduction of the swelling is not planned.

Etiological factors in such a selective edema are obscure.

Proper management consists of aspiration or puncture during the second stage of labor with strict regard for asepsis.

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NEW INSTRUMENTS

POSTOPERATIVE BACKACHE*

CAUSE AND MANAGEMENT BY IMPROVED HOSPITAL BED

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ANY device or measure which minimizes discomfort or adds to the well being of a patient may be said to be a useful part of the care, if not the cure of that individual. One of the most common and distressing complaints of postoperative patients is backache, therefore a consideration of its probable cause and control is timely. The symptom is not limited to surgical patients alone; anyone confined to bed may develop this annoying complication.

BRIEF HISTORY

Before the advent of the modern hospital in the preaseptic days, the surgeon was too engrossed in fighting "hospital gangrene," suppurating wounds and other matters of life and death to worry about the refined comforts of his patients. Then came Pasteur, followed by Lister who applied the Frenchman's discovery and inaugurated antiseptic surgery, and finally the evolvement of our present aseptic methods. With the latter came improvements and an ever widening field not only in the sphere of surgery but in the environment of the surgeon and his patient. Larger hospitals with excellent equipment were constructed and modern methods of caring for the sick were inaugurated. Even the hospital bed was not neglected in this progress. First, the change from wood to metal beds, then the change from circular coil springs to straight link springs which were easier to keep clean and much more uniform, and finally in 1909 Gatch[1] called attention to the necessity for head and knee rests in bed construction, a feature now almost universally employed in hospital bed manufacture.

THE PROBLEM

Patients who have been operated upon under general anesthesia complain of backache soon after consciousness returns and it usually persists for about three days. Da Costa[2] clearly describes it as "a cause of wakefulness aggravated by turning or twisting and by attempting to rise up from the bed. Pain is located in the lumbar and sacral region and is often accompanied by rigidity of the lumbar muscles." Dunlop[3] stated that "The patient during operation lay upon a flat table without support to the lumbar curve, consequently the sacro-iliac synchodroses were strained. The backache may be largely prevented by placing a small pillow so that it will support the lumbar curve during anesthesia."

ANATOMY

The majority of bedfast patients complain of backache which is referred to the lumbar region, the five movable true vertebra which normally form a curve

[1] GATCH, WILLIS D. The Sitting Posture; its postoperative and other uses. *Annals Surg.*, 49: 410 (Jan.–June) 1909.

[2] DA COSTA, J. CHALMERS. Modern Surgery. Ninth Edition.

[3] DUNLOP, JOHN. New York Med. Journal (July 10) 1909.

* From the Department of Surgery, Indiana University School of Medicine.

whose convexity is anterior or lordotic. According to Cunningham[4] there are four curves which, subject to some variation are seen in the vertebral column as a whole,

with the column erect and the head so placed that the axis of vision is directed towards the horizon. There is a forward curve in the cervical region, which gradually merges with the backward thoracic curve; this becomes continuous below with an anterior convexity in the lumbar region, which ends more or less abruptly at the union of the fifth lumbar with the first sacral vertebra where the sacrum slopes suddenly backwards causing the column to form a marked projection—the sacro-vertebral angle. Below this, the anterior concavity of the front of the sacrum is directed downwards as well as forwards. Of these four curves two—the thoracic and sacral are primary, they alone exist during fetal life; whilst the cervical and lumbar forward curves only make their appearance after birth—the former being associated with the extension and elevation of the head, whilst the latter is developed in connection with the use of the hind limb in the hyperextended position, which in man is correlated with the assumption of the erect posture—this curve therefore only appears after the child has begun to walk. For these reasons the cervical and lumbar curves are described as secondary and compensatory.

Since they are compensatory they will naturally vary with each individual, depending on his anatomical type. With this in mind and following Dunlop's suggestion, we placed a small pillow under the lumbar curve while the patient was on the operating table. This procedure did not lessen materially, if at all the incidence of backache. Perhaps the pillow is too yielding to give adequate support.

THE CAUSE

A side view of a patient lying in bed will show that in spite of spring improvement, there is a tendency to sag in the center much like a hammock. This leaves the lumbar curve without support or in a state of "hyperflexion" with its consequent strain on the lumbar muscles, (Diagram F) and rigidity or spasm soon ensues producing pain. No doubt this does not account for all postoperative backache. Some patients have backache before surgery which may be due to trauma to the vertebra or soft parts, referred pain from the pelvis, diseases of the vertebra or pelvic bones, new growths of the spinal cord, etc. Others develop backache postoperatively due to infection, as myositis or fibrositis of the lumbosacral muscles or arthritis of the spine or pelvis. However, the most common cause is acute muscle strain.

THE REMEDY

Physicians and patients alike know the value of lying on a "hard bed" when suffering from backache. Every experienced nurse has learned the simple remedy of placing a pillow under the lumbar curve to support it. Obviously the first consideration in the treatment is correct diagnosis for it would be futile to attempt the treatment of backache, due to rectal carcinoma or spinal cord tumor, by support. However, in that broad group of backaches referred to as traumatic or those due to infections of muscles, as myositis or fibrositis, rest through the medium of proper support is desirable and usually curative. Furthermore, it may prevent an untreated innocent muscle strain backache from becoming a more or less permanent symptom hard to explain and equally difficult to cure.

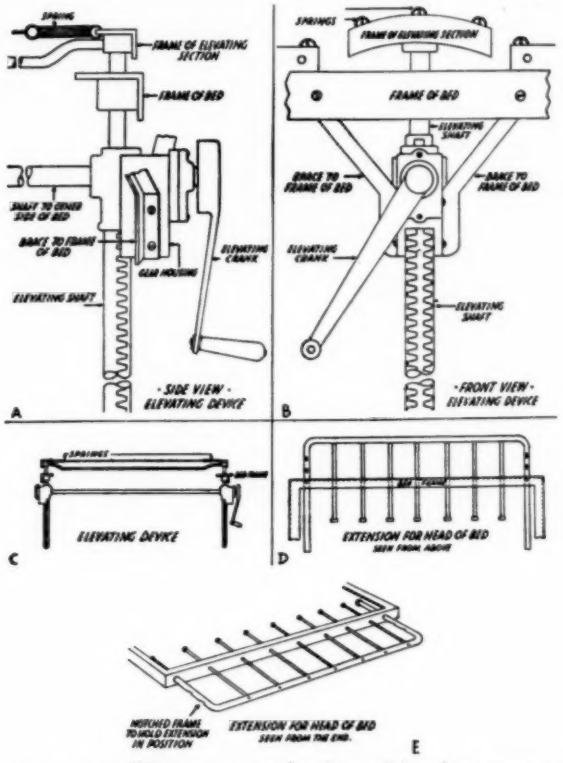
PREVENTION AND CURE

Jepson[5] has shown the advantage of hyperextension in traumatic backache. A blanket roll under the mattress, the Goldthwaite, Cleary, Granberry, and Cole hyperextension frames, the Whitman frame and the plaster cast method of maintaining hyperextension are useful present day modes of treatment. Our method of treating postoperative backache is also by lumbar support or hyperextension if necessary. However, it is obtained by a movable semicircular spring unit incorporated in our regular ward bed, which is lowered or elevated depending on the concavity of the lumbar curve of the patient, by turning the elevating crank (Diagrams A, B and C). The inclusion of this unit necessitated

[4] Cunningham. Text Book of Anatomy. Fourth Edition.

[5] Jepson, Paul N. Traumatic Backache. *Jour. Am. Med. Assn.*, Vol. 101: 1778 (Dec. 2) 1933.

shortening the back rest; therefore, a notched frame was installed, which may be pulled out when necessary for linear type



A, B AND C. illustrates mechanism of lumbar support elevating device; D and E. head rest extension to be used when back rest is elevated and not sufficiently long to meet patient's needs.

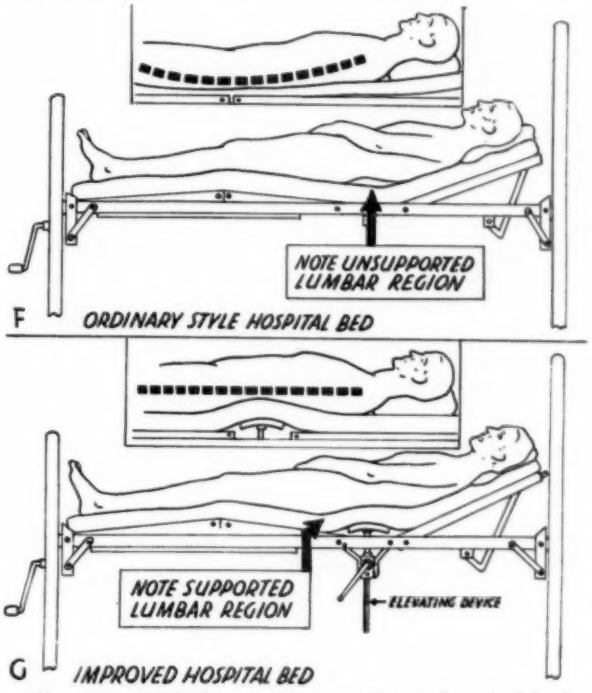
patients (Diagrams D and E). The lumbar support was found valuable even with the back rest elevated (Diagram G).

RESULTS

This bed has been in use in the Robert W. Long Hospital for about a year. All patients who have been put upon it thus far have not complained of backache. One woman with a sacroiliac strain, sustained prior to her cholecystectomy was placed in this bed after surgery. Her pain continued until forty-eight hours later when she shifted her sacrum directly on the lumbar unit and then she was relieved, stating that it gave her support. It is necessary that the patient is correctly placed on the support which should be properly elevated or obviously it will do no good.

DISCUSSION

This bed is not advocated as a panacea for all backaches regardless of the cause; we are simply suggesting that this new addition to the hospital beds will be a distinct improvement and will in an easy yet effective manner relieve the backache



F. illustrates "lumbar sag" in ordinary hospital bed; G. illustrates lumbar support in the improved hospital bed.

due to the causes described. This will make for a smoother convalescence and will add greatly to the comfort of patients. Furthermore, it may prove useful for a back support when needed in other types of backache than those specified.

CONCLUSION

1. The cause of most postoperative backaches is a sagging of the hospital bed producing "hyperflexion" of the lumbar curve and consequently straining the lumbosacral muscles.

2. To prevent this muscle strain, lumbar support is indicated.

3. This is easily obtained by our new addition to the hospital bed which is described.

4. These units may be easily incorporated in the routine manufacture of hospital beds and operating tables.

5. The curvative value of such a bed for other types of bachache is suggested.

The author wishes to express his thanks to Miss Elyzabeth Candy, R.N. for her helpful cooperation, and to Mr. Henry Peters for his aid in the construction of the "lumbar unit."

FASCIAL SUTURE CLAMP

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THE use of fascial sutures in reconstructive operative procedures is well established. Its many applications in

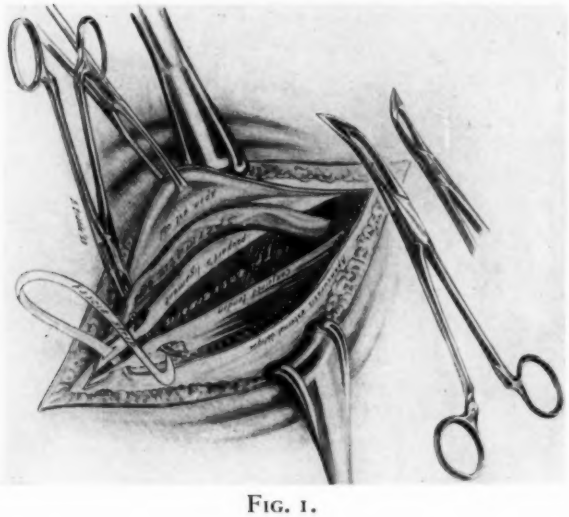

FIG. 1.

nearly every field of surgery needs no enumeration.

The use of a regular Galli needle, or other modifications, all present the same objections, i.e. marked traumatization of structures through which the needle must pass. The Galli needle for example, is broad in construction to cut a pathway for the aftercoming suture but this rent is further expanded by the necessity of sewing the fascial suture in the eye of the needle thereby creating a mass of tissue at this point. In suturing frail or attenuated structures the needle and sewn-in suture thereby often traumatize tissues to the extent that much of the strength and benefit of the fascial repair is lost.

The accompanying drawing illustrates the use of the suture clamp in a McArthur hernioplasty and an anterior and posterior view of the instrument is appended. It may be easily constructed from any curved hemostat by removing the rachet catch at the handle, flattening and sharpening the point to the desired degree and hollowing the proximal portion of the clamp surface. The latter is necessary to prevent catching adjacent tissue when the fascial suture is grasped by the point. Obviously the best method of use is to perforate the structures desired feeding the suture into the clamp and pulling it through, fixing it with a chromic catgut suture or steadying it with an Allis clamp until the next suture is placed.

I believe this suture clamp permits of more accurate placement of fascial sutures, quicker use and much less traumatization than the Galli needle.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

SPONTANEOUS VERSION AT TERM*

PALMER FINDLEY, M.D., F.A.C.S.

OMAHA

OSLER, quoting Fuller, tells us: "Old actions return again furbished over with some new and different circumstances." In conformity with this sentiment and recalling a spontaneous version near term occurring under my own observation, let us turn back the pages of history bearing in mind that "history deals largely with omissions." Thus in surveying the past we gain a better perspective of the present which is another way of saying that we see far when we stand on the shoulders of our ancestors.

Searching for the earliest records of man's conception of the normal presentation of the fetus in utero, we are carried back 4000 years before the Christian era and there we find the Chinese midwife instructing the expectant mother, at the onset of labor to walk about the room to facilitate the turning of the baby from breech to head.

From the historian Neuburger we learn of the ancient Hindus who believed that at the time of labor the fetus lay in the womb with the "head up, the hands folded across the forehead, lying on the right side of the mother if of the male, on the left side if of the female sex; before birth version occurs." At the onset of labor the child by its own volition, turned to a head presentation. In the fifth century of the Christian Era, Susruta, the Esculapius of Hindu medicine, taught that the turning of the baby from breech to head was due to the action of the air in the womb. The statement that a baby born in the seventh month has a better chance to live than if born in the eighth month is generally credited to Hippocrates but is clearly traced to the writings of the ancient Hindus. Thus we are reminded of the great antiquity of the theory of voluntary turning.

Hippocrates likened the position of the baby in the womb to a cork or olive in a long necked bottle; which, in order to make its exit must present one or the other of the ends of its long diameter, all other presentations, he said, demand the assistance of art. He, too, believed that the child willed to make its way head on into the outer world and for reasons not given, the turning from breech to head was consummated in the seventh month of gestation. Few, if any, questioned the authority of Hippocrates until the sixteenth century when Realdo Columbo, pupil and successor of Vesalius in the famous school of Padua, remarked sardonically, "babies do not jump around like monkeys."

* Read before the Central Association of Obstetricians and Gynecologists, Omaha, October 11, 1935.

Aetius of Amida lived in the sixth century A.D. and was called the "Founder of Midwifery." He, together with Paul, Celsus, Pliny and Oribasius formed a group of zealous compilers in the days when Rome was in the zenith of her power. Their works were veritable storehouses of historical data, much of which would otherwise have been lost. Aetius taught that birth takes place when the membranes become too small to retain the fetus, then the child tears the membranes and emerges through its own movements. Not content with crediting the baby with voluntary efforts in turning within the womb to extricate itself from its confines, he fancied the uterus cooperating with the baby. "For," said he, "it is moved of itself hither and thither in the flanks, also upward in a direct line to below the cartilage of the thorax; and also obliquely to the right or the left either to the liver or spleen; and it likewise is subject to prolapsus downward, and in a word is altogether erratic. It delights in fragrant smells, and advances towards them; and, it has an aversion to fetid smells, and flees from them; and, on the whole, the womb is like an animal within an animal."

The "Byrth of Mankynde," published by Richard Jonas in 1540, is an English translation of the Latin edition of "De Partu Homonis," and it in turn of the original German work by Rösslin, "The Rosegarten" which appeared in 1513. Translated into all languages of the continent and Great Britain, this remarkable little book remained for nearly two hundred years the sole printed work on midwifery. It marked the beginning of the pre-Renaissance of midwifery. While in no sense a scientific work it was something and that was all that the midwives, who dominated the practice of obstetrics, possessed by way of instruction, other than that obtained from their own personal experiences and works on surgery. In the "Byrth of Mankynde" we read, "If a child be so faint, weak and tender, that it cannot turn itself or doeth it very slowly . . . also if the child is dead in the mother's belly, it is a very perilous thing, for so much as it cannot be easily turned, neither can it help itself to come forth." Richard Jonas and before him Rösslin, were passing to future generations the age-old fallacy that the unborn child, unassisted by the expelling powers of the mother of which they had not the vaguest idea, was endowed physically and mentally with the essentials of birth. In this respect they had not advanced a whit beyond the concepts of primitive peoples.

There was little that was original in the "Midwives Books." While credit was withheld it is believed that much of their context was taken from the works of Moschion of about the sixth century and from Soranus of the second century A.D. In the many codices credited to ancient authorities, and to Soranus in particular, there are unique birth figures. In these crude illustrations we see the baby in all manner of grotesque attitudes, performing amazing acrobatic stunts. Many of them depicted not babies but adults of mature years. To the modern obstetrician these birth figures appear misbegotten and ridiculous but it must be borne in mind that the "Midwives Books" were written at the very threshhold of the science of obstetrics, at a time when there was much prejudice against the dissection of the human body. They probably originated in the early Christian era with Soranus, the leader of the sect known as the Methodists who scorned the study of anatomy. That Soranus was aware of the changing positions of the fetus in utero is apparent in the birth figures where we find not one but sometimes several babies tumbling over one another in the utmost confusion. These figures, in modified forms, appeared in works on obstetrics to the time of Mauriceau and Guillemeau in the seventeenth century and were borrowed without leave or ceremony by every author of a text on obstetrics to the time of Smellie. Verily, Soranus was the "best robbed man in all medical history."

If credit is due any one individual for the Renaissance of midwifery that man is Ambroise Paré. A military surgeon, and not an obstetrician, Paré, revived the ancient practice of turning. Endowed with a high degree of sagacity, and what we moderns call common sense, he was not immune to the whims and superstitions of his day. Paré believed in magic and witchcraft but did not subscribe to the belief of the ancients that monstrous babies were begotten by the devil. Having divested himself of his ancient vagary, he proceeded to commit himself to an equally absurd theory when he announced that the baby is endowed with an instinct that causes it to turn from a breech to a head presentation in the seventh month, and if born at that time it would have a better chance to survive than if born in the eighth month, when it would not have had time to recover from the exertion put forth in the act of turning.

Paré was giving expression to an ancient hypothesis for we have the word of Rhazes, the Arabian of the ninth century, a Galenist, albeit a disciple of Hippocrates, that an eight months baby had not so good a chance to survive delivery as did a seven months baby. Said he: "Before the seventh month the head of the foetus lies upward; after that it declines downward; the child needs time to recover from this exertion and so an eight month foetus is more apt to die than a seven months foetus."

The immortal Harvey, called by Aveling the "Father of British Midwifery," gave the following graphic description of the fetus in utero:

> He swimmeth in a water and moveth himself to and fro, he stretcheth himself now this way, and now that, and so is variously inflected and tumbled up and down, in so much as sometimes, being entangled in his own navel strings he is strangely ensnared . . . and the great bellied woman knows full well that she does sometimes acquire a different situation when she find the child kick sometimes above, sometimes below and now on the side and at other times on that.

Harvey clung to the age-old belief that the baby made its own way through a narrow passage to the outer world; that before the onset of labor the baby turned a somersault within the uterus, in order that the head might present at the portal of the womb, opening it by its own energies and thus struggling into day. Said he:

> Not only do birds break through their shells but all kinds of flies and butterflies pierce their delicate membranes in which they are encased; the silkworm softens by moistening and then eats through the silken bag, and wasps, hornets, and fishes of every kind are born by their own will power. . . . There is the fable of the young viper eating through the womb of its mother to avenge the death of its father, doing just what the young of every species does in breaking through the membranes which encase it.

To clinch his argument Harvey cited incidences of babies leaving the womb on their own power after the death of the mother.

William Smellie, perhaps the greatest of English obstetricians, opined that the baby does not turn a somersault, head on into the pelvis and his distinguished pupil, William Hunter, thought it absurd that the baby should be made to perform the tricks of a tumbler or rope dancer.

Foremost of the French obstetricians of the seventeenth century was Francis Mauriceau, of whom Levret remarked: "He drew from the cradle the art of midwifery." He was the first of that illustrious coterie of obstetricians, Peu, Portal, Guillemeau, Deventer, La Motte, Smellie, William Hunter and Levret, who marked the most brilliant epoch in the history of midwifery. Mauriceau professed belief in the voluntary evolution of the fetus and held that the birth of a dead baby was more difficult than that of a living one because it could not put forth the required exertion. Writing in the eighth edition of his "The Diseases of Women with Child and in Childbed etc.," he said:

> For the great endeavors often necessary to be used in turning the infant in the womb

(which is a little harder than to turn a pancake in a frying pan) does so weaken both mother and child, that there remains not afterward strength enough to commit the operation to the work of nature and usually the woman has no more throws nor pains fit for labour after she has been so wrought upon . . . the infant would certainly perish in the passage, without being able to be born.

John Maubray was England's first clinical instructor in obstetrics. Author of the "Female Physician" published in 1734, he expounded the mysteries of astrology, for Maubray believed that the planets guided the destinies of the mother and child. He believed in the magic of the number seven, that the seven planets have dominion over man from the moment of his conception. He agreed with "Learned and Curious Practisers in Midwifery" that birth always happens at the selfsame hour of the day or night in which the woman conceives and that this accounts for most births happening in the night or early dawn. He taught that an eight month's birth is always weak, if not half witted, but offered no explanation.

Mauquest de la Motte was a rural practitioner, living in Picardy at the tip of a French province that was almost surrounded by the sea. He was the last of the illustrious obstetricians of the seventeenth and eighteenth centuries (Mauriceau, Peu, Portal, Deventer, Siegemundin). With typical practicality de la Motte maintained that in the early months of pregnancy the baby is so small that it can assume almost any position in the mother's womb, but at a later time the position of the fetus is determined by the resistance of the walls of the uterus, as well as by the capacity of the uterus. Thus he foreshadowed the theory of accomodation. Having committed himself to this sensible conclusion, de la Motte wandered into the shadowy realm of fantasy when he said the child changes its position each time that it feels the need to do so and affirmed that the "spirals of the cord" exercise a controlling influence on the changing position of the baby.

Credit is given to de la Motte, Smellie and Baudelocque for having finally demolished the ancient fallacy of self determination on the part of the infant and for substituting the theory of gravitation. But this famous coterie of obstetricians were not to go unchallenged. John Burton of York, immortalized by Lawrence Sterne as Dr. Slop in Tristram Shandy, invented the forceps which Simpson said "worked like a lobster's claws" and contended that the baby turned near the hour of labor from a breech to a head, when with its back to the abdomen of the mother, the mother lying on her back, the baby seemed to creep into the world on its hands and knees.

In support of the theory of gravitation we read from the pen of Jean Astruc, in his six volume work on the diseases of women, published in Paris in 1761–1765:

In this state, the infant has his head upwards and his feet towards the orifice of the uterus, with his face towards his mother's abdomen. During the first six months he remains in this situation, his head being towards his mother's navel, for his feet are, during that time, specifically heavier than the head; but this part begins at length to grow faster, in proportion, than any other; wherefore its superior weight turns the head downwards towards the orifice of the uterus, just as we see a ball of lead joined to a piece of cork, by its specifical weight to sink, whilst the cork floats on the surface, or keeps the superior parts. This change of situation of the infant is owing to the speedy growth of the brain. He is thus turned about fifteen days or three weeks before the delivery, which the midwives, nay, the mothers, perceive at that time, wherefore they say that the belly has then fallen.

Thomas Denman was one of England's greatest obstetricians. His "Introduction to the Practice of Midwifery," in the opinion of Herbert Spencer, is, the most splendid work on midwifery in the English language. Denman was first to give a detailed description of spontaneous version of the full term fetus and in recognizing the

possibility of a voluntary correction of a malposed fetus he counseled deliberation in the conduct of labor. "This," said he, "should certainly put us on our guard against hasty determinations, upon what is possible or otherwise, in any case; or upon the use of any means, which may be destructive to the child, or injurious to the mother." In commenting upon the ancient theory of spontaneous version at the seventh month Denman suggested that possibly the sponsors of this hypothesis feared that fatal consequences would result from the persistence of the fetus with its head downward for the full nine months of gestation.

Not to be outdone by his confreres and predecessors, who fixed the time of turning anywhere from the seventh month to the onset of labor, Velpeau contended that men forget that the fetus is doubled up in the amnios; that even at full term the child sometimes changes its position during labor; that the diameter passing from the occiput to the coccyx does not always exceed the length of the horizontal diameter of the womb.

Valpeau, writing in 1838, observed that "the different points of the foetus, though very remote from each other, may, during a labor, present alternately at the orifice; that positions of the back or shoulder may be converted into positions of the head or breast; that positions, in appearance the most unfavorable, might sometimes be replaced by normal positions, were all accoucheurs sufficiently well informed to know how to wait." Velpeau was strengthened in his faith in the corrective powers of nature by observing a spontaneous version of a shoulder presentation ten hours after the bag of waters had ruptured. He favored the gravitation theory and laid stress upon uterine contractions as a contributing factor, "It is," said he, "quite a natural phenomenon, easily explained by the action of the womb and its relation to the form of the ovum and foetus."

Tarnier would have none of the nonsense of the ancients who held to the fallacy of instinctive will of the fetus in turning. "The fetus," said he, "shut up in a closed sac, and constantly subjected to movement, must assume, not instinctively but mechanically, such a position as will bring its largest parts into correspondence with the most spacious portions of the organ." Tarnier was an exponent of the *theory of accommodation*.

Placing a dead fetus in a volume of water, Dubois observed that all parts descended with equal rapidity, and further observed that women lying in the prone position because of ill health, do not exhibit head presentations oftener than ambulatory cases. He reasoned that the laws of gravitation did not determine the position of the baby, nor did he believe that the fetus was suspended by the cord. The insertion of the cord nearer the pelvic extremity of the fetus cannot influence the position of the baby because the cord is longer than the longest diameter of the uterus. In his *theory of accommodation* Dubois was supported by Sir James Y. Simpson and Scanzoni, Pinard and Sellheim.

Mathews Duncan placed a baby, recently dead, in a bath of normal saline solution; the head sank to a lower level than the breech. Duncan reasoned that a similar process occurs in the amniotic fluid which accounts for the relative frequency of vertex presentations. His experiment with the saline solution was challenged by Schatz. It is known that the specific gravity of the amniotic fluid is lighter than that of a normal saline solution. Schatz placed a dead fetus in a solution of the same specific gravity as the amniotic fluid and the breech of the child sank below the level of the head. He then raised the specific gravity of the fluid and the head sank below the level of the breech. This, to Schatz, was conclusive evidence that gravitation alone will not account for the frequency of head presentations; that other factors must also be reckoned.

Turning to the more modern authorities we read that Schultze, Fasbender and P. Muller all made repeated observations on

the pregnant woman and observed that the baby turned, not once, but many times in the latter weeks of pregnancy. In a para 1, Muller relates that the baby turned six times in five days. Holing contended that the baby shifts its position with the changing attitude of the mother. He observed a woman in the erect position in whom the back of the baby presented on the right side and upon assuming a reclining position the back of the baby shifted to the left. More convincing evidence is that of Warnekros who demonstrated with *x*-ray studies that a vertex could be converted into a breech presentation by placing the woman in the Trendelenburg position, thereby reversing the act of gravitation.

To the theories of gravitation and accommodation may be added that proposed by Wigand, who said that the contractions of the uterus in late pregnancy "bring the baby into a convenient position." His theory was supported by Credé, Gonriet and Kristeller.

Modern authorities are generally agreed that gravitation is a factor to be considered in the early months of pregnancy, but in the last two months the process of accommodation between the fetal ovoid and the uterine cavity plays the important rôle in determining the ultimate position of the fetus. Nowhere in modern literature is mention made of voluntary evolution of the fetus.

The case which came under my observation presented a graphic picture of the mechanism of spontaneous version. The woman, a para v, aged forty years, was approaching full term when seen. Three doctors had examined her and could not agree on the diagnosis. Accordingly, a skiagraph showed the baby presenting by the breech (L.S.P.). The baby was of normal size, 7.5 lb. and there was no excess of amniotic fluid. For several weeks the patient had suffered pain in the right upper quadrant. Two days after the first skiagraph was taken there were violent movements of the baby; so great that the mother was thoroughly frightened. Then, she said, the uterus tightened and she felt something slip high on the right side. This was followed by a cessation of the fetal movements, a relaxation of the uterus and complete relief from pain in her right side. A second skiagraph revealed a vertex presentation (L.O.P.). She was delivered of a healthy baby within twenty-four hours.

The story told by the mother suggests that the baby initiated the act of turning and that the revolution was aided by the contractions of the uterus.

BOOK REVIEWS

A Treatise on Medical Jurisprudence. By Benton S. Oppenheimer, LL.B., LL.M., Professor of Law, College of Law, University of Cincinnati. Price, $4. Pp. 290. Baltimore: William Wood & Company, 1935.

Professor Oppenheimer's little volume would be more accurately entitled, "A Treatise on Certain Aspects of Medical Jurisprudence." It consists, the author tells us, of material originally gathered for a half dozen brief symposia which has "gradually grown into this volume," and which the author hopes may be helpful to "practicing physicians, nurses, social workers and lawyers." Of the 263 pages of reading matter in this book, the first 100 will prove of interest to physicians and surgeons; the chapter on Hospitals, pp. 217–227, might prove of interest to nurses; none of the book, in this reviewer's estimation, bears directly upon the problems of social workers; and the balance of the volume, covering approximately 150 pages, is a technical legal discussion of actions at law and admissibility of evidence, with full citation of cases, which may be "helpful to those lawyers who are occasionally required to deal with medico-legal problems."

It is to be hoped that in future editions the treatise will be re-written according to plan, as the importance of the subject deserves, and not just grow by putting cloth covers around a number of vaguely related lectures and law memoranda. There is little conceivable relation to the subject of medical jurisprudence in the discussion of "Dying Declarations," pp. 231–237. The final chapter, entitled "Miscellaneous," ends with a lengthy quotation from the Bulletin of the National Research Council. The discussion of admissibility of evidence belongs more appropriately in a legal journal. It quotes profusely from Wigmore on "Evidence," and adds nothing original to the legal subject of evidence. On the other hand, the first 100 pages of the book, devoted to the rights, obligations and privileges of the medical fraternity, is a well written, interesting discussion which every medical man may profitably read. This part of the book should be expanded. More particularly, the topic of the doctor in the courtroom should receive greater treatment than the four pages now allotted to it.

Successful trial lawyers, in cases involving medical aspects, explain to their medical witnesses just what the legal issues are and the limitations of legal proof in the case about to be tried. If the doctor in court, whether as fact witness or expert opinion witness, gives a bad account of himself, this reviewer believes that in almost every such case it is indicative of faulty preparation by the lawyer who calls him. If a doctor's temperament is such that he will not prepare himself adequately for court testimony, he should not be permitted to testify as an expert witness. All doctors testifying as fact witnesses should be warned to bring with them their records of treatment. This topic, with copious illustrations from actual court cases, should make interesting reading to the surgeon and physician.

The chapters on "Duties and Obligations of Physician to Patient," and on "Malpractice," are especially commended to the active medical practitioner.

A word of caution is necessary, with respect to certain forms advocated by the author as legally safe. This reviewer questions the adequacy of the form, on p. 227, for the release of information by a hospital, upon the request of the "nearest relative" of the patient, particularly information "pertaining to any form of venereal disease." A similar "relationship form" on p. 253, authorizing the performance of an autopsy upon a deceased relative, also throws the burden upon the pathologist of guessing correctly whether the relationship is legally adequate in each case. Similarly, the form on p. 40, which attempts to release in advance the operator of *x*-ray apparatus, is questionable. No hospital or doctor should rely upon any forms without consulting their own attorneys in each case.

The Diagnosis and Treatment of Diseases of the Peripheral Arteries. By Saul S. Samuels, A.M., M.D. New York, Oxford University Press, 1936.

This is an excellent monograph on an important subject. Dr. Samuels bases his study

on the results obtained during the past ten years, in the treatment of over 350 cases of thrombo-angiitis obliterans and of a large number of cases of peripheral arteriosclerosis.

The author says that the primary purpose of his monograph is to offer scientific proof of the fact that a "new viewpoint on the peripheral arterial diseases must be taken. The old idea that every case of thrombo-angiitis obliterans must sooner or later terminate in a series of amputations must be considered a relic of medieval surgery." With this in view the greatest stress is laid upon the minute details of treatment.

There is an ample Index.

To those whose work include the diseases of the peripheral arteries we recommend this book.

THE HUMAN FOOT. Its Evolution, Physiology and Functional Disorders. By Dudley J. Morton. New York, Columbia University Press, 1935.

This book plainly shows it was written by one with the proper scientific background to undertake a work of this kind. It is a book that those whose work in medicine embraces a consideration of the human foot, will do well to study carefully. Naturally, orthopedic surgeons will read it with interest and profit.

The author frankly states in his preface that an interest in this subject "naturally prompts a desire for further knowledge" and he hopes his work will "stimulate more active research in this field." The author further states, "Physiological study of foot ailments, as developed in the following pages, reveals the fact that the distribution of weight upon the different segments of the foot is of major importance. This constitutes a definite departure from the morphological basis of such studies now general, wherein changes in the foot's position or contour are considered the dominant feature. For physiological analysis has revealed certain structural factors whose influence in disorganizing the normal mechanism of the foot are clearly demonstable."

Part I, deals with The Evolutionary Development of the Human Foot: Part II, with The Physiology of the Human Foot: Part III, with The Functional Disorders of the Human Foot.

A bibliography has been purposely omitted, but for those who desire additional reading a list of reference and textbooks is given. There is an Index.

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